PENOBSCOT INDIAN NATION
FINAL SCIENTIFIC/ TECHNICAL REPORT
2005-06

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Penobscot Indian Nation
12 Wabanaki Way, Indian Island
Old Town, Maine 04468

"PENOBSCOT INDIAN NATION'S STRATEGIC ENERGY PLANNING EFFICIENCY ON TRIBAL LANDS"

Ms. Brenda Fields, Project Director

Mike Sockalexis, Tribal Energy Coordinator
Doug Baston and Ed Holt, Energy Consultants
Alan Mulak, Energy Efficiency Consultant
Tribal Energy Committee

November 17, 2006

Penobscot Indian Nation

Final Scientific / Technical Report

<u>Table of Contents</u>

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EXECUTIVE SUMMARY

The research provided a more comprehensive understanding of energy resources, which resources to pursue in what priority, and specific next steps, especially for investing in energy efficiency. Best practices were used in development of Strategic Plan and Energy Resource Analysis. Technical Expertise was provided by Doug Baston of North Atlantic Energy Advisors and Ed Holt of Ed Holt and Associates. It was their due diligence and attention to detail that contributed to the success of energy grant.

Energy audits are a well known method to identify energy savings opportunities. In our view the key is to get a technically competent engineer who can provide practical and specific recommendations that are clearly communicated. PIN found it useful to use a competitive solicitation process, including a requirement for a sample audit, to find such a person. Alan Mulak, PE, LLC did an excellent job for us.

The methods used to evaluate the energy efficiency conservation measures (ECM) related to electricity use apply equally to the other energy resources. It is PIN objective to implement ECM in order to significantly impact electricity, oil, gas consumption and related costs. The savings can be substantial and reduction in energy use would drastically decrease. The estimate ECM implemented will have a payback of 2.5 years.

The hydro maps of Idaho National Energy Laboratory are useful to identify potential hydro sites, but require a high level of mapping software expertise to layer onto tribal maps. The digital wind maps of the National Renewable Energy Laboratory are excellent as a way to visualize wind potential and are easy to access (requiring only latitude and longitude inputs to navigate); computer skills are needed to overlay on tribal maps.

Recommendations for the development of further tribal institutional capability relating to energy and energy facility siting procedures may be of interest to other tribes.

And finally, PIN, with other Mane Tribes, contacted the Venezuela Embassy and CITGO in October 2005 regarding their assistance on discounted home heating oil. An article in newspaper stated that CITGO was providing home heating oil to Bronx community in New York after President Hugo Chavez visited New York. PIN received a positive response and eventual assistance. In October of 2005, key Congressional leaders sent an open letter to all oil companies to aid in helping America's poor people, but only CITGO responded.

ACCOMPLISHMENT OF GOALS AND OBJECTIVES:

The Energy Project would not be a success without the hard work and participation of the members of the Energy Committee: Charles Francis, Kirk Francis, Robbie Dana, David Pardilla, William Thompson, and Chris Mitchell. The Energy Committee was appointed by the Tribal Council in August and September 2005 to provide oversight and project direction. Mike Sockalexis was assigned the responsibility to manage project in September 2005 and he utilized the expertise of two consultants Doug Baston and Ed

Holt of North Atlantic Energy Advisors for Strategic Energy Planning and Energy Development Project. Alan Mulak, PE, LLC, was contracted conduct the energy audit. The overall supervision was done by Brenda Fields, Tribal Administrator for Grants and contracts.

Special thanks must go to Lizana Pierce, Project Officer, DOE Tribal Energy Programs, for her technical support and encouragement as PIN implemented and executed the project activities.

Also, thanks must go to State of Maine Director of Energy Independence and Security, Beth Nagusky, for her assistance, encouragement and support as PIN developed its wind resource on its trust land in Western Maine.

PIN wishes to knowledge the efforts of both Eastern Maine Development Corporation (EMDC), most in particularly, John Holden, Acting CEO and Tim Love for PINE for their due diligence along with Yvonne Francis-Ferland, President of PINE, for her leadership in negotiating the PIN/PINE MOU with TransCanada.

The **Goal of this project** is to develop a first step ***"energy vision"*** which both incorporates the following two overarching Principle Objectives established by the Nation and provides a policy framework for a more detailed – and prioritized – **Long Term Strategic Energy Plan**.

The <u>First Objective</u> is to address the cost burden of our current energy dependency. To do this, we must both explore ways to make our existing tribal public facilities and private residences more energy efficient and look at alternative ways to purchase fuel supplies (such as through oil, propane, natural gas or electricity bulk purchase agreements or aggregations).

PIN made major progress towards achieving this objective. Using grant funds, PIN arranged for an energy audit of tribal commercial facilities by a professional engineer, Alan Mulak, PE. The audit of the 13 largest commercial (tribal) facilities identified current energy use and costs, but more important, it makes specific recommendations for energy conservation measures addressing the electric, oil and gas usage in the facilities. These recommendations identify the expected capital cost, energy savings, cost savings, and payback for each measure for each facility.

In review of literature, energy efficiency programs, if adopted completely, do have a large potential to reduce costs to tribal governments and reservation residents. Some Indian households spend at 20% of their income on electricity, so cost savings can be very important to these households (Energy Information Administration 2000). Studies further state that secondary benefits from energy efficiency improvements and energy conservation can contribute to energy independence and improved tribal sovereignty. In a practical sense, energy efficiency measures frequently improve the performance and longevity of existing energy systems.

All energy efficiency measures, if implemented, would result in a capital cost of $165,000 ($128,000 after state rebates) and would save $64,000 per year for an overall two year payback. Most of the savings would come from electricity efficiency (279,000 kWh per year), though some would come from oil (6,791 gallons per year) and propane (1,100 gallons per year). PIN is looking at the possibility of applying some of our current savings in fuel oil costs to help fund the initial capital investment with the idea of matching these funds with incentives available from Efficiency Maine.

Efficiency of Maine is a statewide effort to promote the more efficient use of electricity, help Maine residents and businesses reduce energy costs, and improve Maine's environment. Efficiency of Maine is funded by electricity consumers and is administered by Maine Public Utilities Commission. Also PIN will secure home heating resources at low cost or reduced cost or at bulk rate use. According to U.S. Department of Energy, Maine is among the highest spenders on energy in the country. As such, Maine continues to encourage energy efficiency and the use of renewable nergy.

PIN has not yet explored specific energy savings potential in our private residences, but we addressed that in general through aggregated purchasing of fuel oil supplies. For the 2005-06 heating season, PIN negotiated with CITGO, the oil company owned by the Venezuelan government, to obtain heating oil at a significant discount of roughly $1.40 per gallon based on $2.40. For the 2006-07 heating season, PIN continued to work with representatives of CITGO and with the Venezuelan government on bulk oil purchasing for all Indian tribes in Maine and in northern States where temperatures are cold. As the results of negotiations, Tribal Representatives, for their effort, were able to obtain free fuel oil for all tribal and residential needs on the Reservation for the 2007 cold season. Members of PIN Negotiating Team are Erlene Paul and Clarice Chavaree, Tribal Human Services, Brenda Fields, Tribal Administrator of Grants and Contracts, James Sappier, Tribal Chief and Mike Sockalexis, Energy Project Coordinator.

The home heating oil program began by the Maine Tribes' initiative by contacting CITGO and the Venezuelan Embassy in the fall of 2005. The effort put forth on part of then Tribal Chief, James Sappier and Micmac Band Chief Billy Phillips and the friendship they forged with CITGO Representatives made the program very successful. Also, the program administration by Erlene Paul, Director of PIN Human Services, on behalf of all Maine Tribes was exceptional. The success of Maine Tribes made it possible for the home heating oil program expand to sixty-four tribes and in 2006 provided 100 million gallons of home heating oil.

To reiterate, the methods used to evaluate the energy efficiency conservation measures (ECM) related to electricity use apply equally to the other energy resources. It is PIN objective to implement ECM in order to significantly impact electricity, oil, gas consumption and related costs. The savings can be substantial and reduction in energy use would drastically decrease. The estimate ECM implemented will have a payback of 2.5 years. By implementing ECM PIN can realize its goal, ***"Reduce energy usuage and cost in tribally-owned facilities and in home of tribal members."*** (p.9, PIN Long-term Strategy Energy Plan)

Finally, one of the recommendations of the Long-Term Strategic Energy Plan is to investigate the feasibility of establishing our own tribal utility to provide electricity to the tribe and its members at a lower cost than is presently available. In doing so, PIN can then achieve its major objective of energy self-sufficiency and exercise tribal sovereignty..

In terms of facilitating public policy, to that end, PIN has participated in the State of Maine's Public Utilities Commission's Renewable Resources Stakeholders Group (RRSG) and was included in Legislative Report on the Viability of Wind Power Development in Maine. Both reports were presented to the Joint House/Senate Utilities and Energy Committee of the 122nd Maine Legislature in 2006.

The objective of RRSG Report was to *"Examine the benefits and costs of renewable generation in Maine and develop strategies to maximize renewable generation that is cost competitive."* Key element in report was the positive statements about the development of wind power. PIN is currently assessing federal, state energy funding sources to prepare grant applications for funding to further develop tribal wind resource and to develop energy efficiency measures.

The Second Objective is to address opportunities for renewable energy production. In doing this we must consider the environmental impacts of potential sources of renewable energy; the economic development

potential of each source (including associated, indirect economic development aspects); and the long-term cost and reliability of each.

PIN has also made significant progress towards this objective during the course of the grant. We reviewed the renewable resources potentially available to the Nation, including hydro, wind, biomass, geothermal and solar energy. The analysis of Penobscot energy resources was in part conducted using several digital resource maps available through the federal national laboratory system. In each case, potential resource sites were located and marked on topographical maps of tribal land holdings – reservation, trust and fee lands. The intent was to draw attention to geographic areas of greatest technical potential, and, conversely, to eliminate those areas with no or marginal potential. Areas identified as high theoretical potential, based on the modeling, would require rigorous on-site measurement and analysis in order to verify and quantify the actual resource potential.

Situated on the Penobscot River, the Penobscot Nation has available a lot of hydro energy potential, most of it already developed. For this Energy Plan, PIN consulted new hydrographic models created by the Idaho National Laboratory (INL) using national level satellite data and analysis. PIN understands that INL is the lead laboratory for engineering support for the DOE Hydropower Program. INL continuously test new turbines for low head for its environmental, societal and economic benefits, as well as technology application and technology transfer. These research laboratories of INL, NREL and Sandia Laboratory all have technology information, and digital maps which can be overlaid on tribal lands and identified approximately the 20 MWs of small capacity low head, low power hydro sites, which consist of less than 1 MW and 30 ft of hydraulic head.. These potential sites will have to be examined on the ground further to determine engineering and economic feasibility. As further study may show, low-head, low power resource development on tribal lands with river and stream may assist tribes and nations to be energy self-sufficient and a means to establishing internal institutional capacity-a tribal utility.

According to review of literature, The Idaho National Engineering and Environmental Laboratory in "with the U.S. Geological Survey recently completed assessment of all 20 hydrologic regions in the United States…" (Carroll, Gregory and Kelly Reeves, 2004). The assessment provides estimates of the amount of low head/low power potential, as well as, determining the different power classes of water energy resources. They used the state-of-the art digital elevation models and GIS in the assessment. PIN found this data quite useful in assessing tribal lands of water resource potential and further feasibility study will be needed to determine its economic benefit and for consideration of environmental impact.

Wind resources are strong in two of our land holdings—one trust land, the other fee land. Although we already had an anemometer collecting wind data at one of these sites at 40 meters, we also used the digital wind resource maps of the National Renewable Energy Laboratory to check on potential wind sites across all tribal properties. This led to our conclusion that sufficiently wind resource sites are limited to two tracts of land in the western mountains of Maine.

PIN conducted a RFP solicitation for a wind development partner, and PIN/PINE are currently working with the chosen wind developer to conduct the necessary environmental and technical feasibility studies for the trust land site at Alder Stream Township (AST) in western Maine. Apart from normal wind development hurdles, the biggest challenge facing PIN will be to arrange financing for an equity ownership position in the wind project of 49%. PIN/PINE is working with a financial advisor to scope out the potential financing resources available o PIN.

Penobscot lands also hold tremendous biomass potential. Most of this is forest land that is sustainable managed for pulp logs and to a lesser extent for saw logs. Because forest growth on the Nation's lands has a much higher value for these purposes than for energy, production for the primary purpose of biomass fuel is not, and will not be, a part of the Nation's forestry future. Management for the higher uses identified does produce some wood waste that could potentially serve as biomass fuel stock, but this byproduct by itself would not provide the foundation for an economically viable biomass electricity generation station.

Maine has low to moderate temperature geothermal resources that are not suited to electricity generation, but that can be tapped for direct heat or for geothermal heat pumps. In fact, our energy audits identified two or three potential applications for geothermal heat pumps, but this is not seen as a major future source of energy unless housing on the reservation were converted from oil heat to geothermal.

Finally, Maine has plenty of solar energy potential, but converting it to electricity is expensive. We recommend that it be evaluated for inclusion in any new building design, or for buildings that may be constructed off-grid.

In comparison of the actual accomplishments with the goals and objectives of the project, the starting time for grant began in September of 2005. All project action steps and schedule outlined in grant were 90% completed on time. The following action steps were not completed as scheduled:

1. ***Month Three (December 2005)*** was completed in January 2007, one month later than scheduled. The task was ***"Energy Committee and consultants review RFP/RFQ responses, conduct oral interviews, if necessary, select proposed contact(ors), and assist with contract and scope of work negotiations, as requested."*** Reason for delay was two fold: 1. Because of nation wide response to RFP and RPQ and holidays in November and December, the time was extended in receipt of solicitations. 2. Also the difficulty of scheduling interviews in person and by conference calls. RFPs came from as far Florida, Colorado and Oregon. From due diligence , PIN was told that it had the five top wind developers in United States and Canada
2. ***Month Seven (April 2006)*** saw the extension of time for completion of task of *"**Energy Vision and the review and approval by Tribal Council"*** by end of April. This task did not take place until July 7, 2007 for draft to Tribal Council and September 12, 2006 for Final approval by Tribal Council and Energy Committee.

The reason for delay was the information and data needed for completion in part was NREL's non-responsiveness to technical assistance needs of PIN.

3. ***Month Seven (April 2006)*** task scheduled for April ***"Baston/Holt work with NREL and SNL to match issues and goals described in Energy Vision process to federal laboratory technical assistance resources available to address tribal needs"*** was not unable to be completed until June 2006. The reason was that NREL and SNL were overcommitted in their resources to other tribes and non-Tribal organizations that they could not provide direct technical assistance to PIN during the grant period. The consultants were able to secure available wind, biomass, hydro and solar data and GIS Mapping data from the Idaho National Laboratory (INL) and existing resources. The task was completed and draft submitted to Tribal Council and a power point presentation by Ed Holt and Doug Baston was provided. It is important to note here that INL performs research and engineering in support of the development and application of renewable energy.

Generally, the project in totality was successfully completed. The only outstanding task is the completion of MOU with the wind power developer TransCanada. The PINE negotiating team has set December 31, 2006 as deadline for completion of MOU. A counter MOU and finance proposal of PIN/PINE project costs has been sent to TransCanada as result of meeting in September regarding PINE response to their initial MOU and financing PIN/PINE project costs for consideration. In the mean time, TransCanada has moved forwarded in development of Kibby Township adjacent to Alder Stream Township. They have submitted a permit application to Maine Land Use Regulatory Commission (LURC). The Alder Stream Township application can be ready to submit to Maine LURC in March 2007 once MOU is approved.

SUMMARY OF PROJECT ACTIVITIES:

The completion of tasks focused on the project activities in the four major identifiable project deliverables:

1. **"Vision" and Strategic Planning;**
2. **Alder Stream Township Wind Power development;**
3. **Commercial Facility Energy Audit;**
4. **Discount Home Heating Oil from CITGO**

In addition, PIN published two significant project documents: ***Long-Term Strategic Energy Plan*** and the ***PIN Commercial Facility Energy Audit***. These two documents are the project's key deliverables. The number of meetings, the many conference calls and emails all were in the effort to coordinate and direct the project to its successful completion. PIN has identified the work products completed for each quarter and will be listed in under Project Deliverables at end of this Report. In addition, these two reports include all facts, figure and statistical charts that reflect the narrative portion of this technical report.

First Quarter-September 1, 2005 to December 31, 2005:

The effort for the first quarter was on organization of project, getting two consultants on board from North Atlantic Energy Advisors; begin drafting RFPs and RFQs for the selection of Wind Power Energy Developers and Commercial Energy Auditors. Also it was when the Tribal Energy Committee got formed and briefed on Scope of Work of Energy Grant. Mike Sockalexis, Energy Project Coordinator developed an Energy Briefing Notebook for Energy Committee. During this period, Mike Sockalexis with two energy consultants, Doug Baston and Ed Holt provided a Project Status Report to Tribal Council. Mike Sockalexis, Project Energy Coordinator attended the 2005 DOE Tribal Energy Program "*First Steps"* Review in Golden, Colorado. The initial meetings with CITGO took place to provide discount home heating oil at $1.40 per gallon for 2005-06 cool seasons.

- Executed contracts with initial consulting team, Doug Baston of North Atlantic Energy, and Ed Holt of Ed Holt & Associates.
- Consultants meet with PIN Energy Committee in October 12, 2005 for input on RFPs and RFQs for potential consultants to project.
- Consultants draft RFPs and RFQs for Energy Audit and Renewable Energy Development, and secured PIN Energy Committee approval.
- Consultants generate bidder lists, issue RFPs & RFQs and addressed bidders questions
- PIN Energy Committee organized and briefed by selected Project Coordinator, Mike Sockalexis and Two Project Consultants: Doug Baston and Ed Holt

- Project Coordinator, Consultants and Energy Committee reviewed RFP and RFQ responses
- Mike Sockalexis established internal PIN Grant files and energy program folder for PIN Energy Committee.
- In October and November 2005, Project Status Report to PIN Tribal Council and a power point presentation given to Tribal Council and Energy committee by Energy Coordinator and two consultants.
- Program Presentation to 2005 Tribal Energy Program "*First Steps*" Review, Golden, Colorado (Mike Sockalexis)
- Attend two DOI/CERT conference/workshops in Denver, Colorado in October and November, 2005, by Mike Sockalexis at DOI "*First Step*" Conference PowerPoint Presentation.
- PIN/Department of Natural Resource prepares initial GIS Mapping of proposed site at Alder Stream Township.
- Gave Project Status Reports to PIN Land Committee and update Wind Power presentation to Tribal Council in October and November 2005 with Tim Love, PIN Economic Development Manager.
- Attended initial meetings with CITGO and other Maine Tribes on CITGO's Discount Home Heating Oil Program for Low Income people.

Second Quarter- January 1, 2006 to March 31, 2006:

The project was quite busy this quarter. The key project activities were the selection of Wind Power Developer and Energy Efficiency Auditor. In addition, Doug Baston and Ed

Holt completed the first draft of Energy Vision/Strategic Plan for review by Energy Committee as result of meetings in first quarter. Alan Mulak, PE, LLC commenced energy audit field work in March. Mike Sockalexis, Energy Project Coordinator, secured all building plans per Alan Mulak's request and scheduled meeting with Tribal Facilities Director, David Pardilla. PIN would provide assistance where needed to complete the energy audit.

From the list of potential wind power developers, the Tribal Energy Coordinator, Tribal Energy Committee and the two Project Consultants, Doug Baston and Ed Holt reviewed RPP and RFQ proposals and verified information and background of wind developers. TransCanada was selected as Wind Power Developer for the proposed 100 MW Alder Stream Township Wind Power Project. Several events happened in March. TransCanada provided a power point presentation to Tribal Chief and Council and then they transferred responsibility for project to Penobscot Indian Nation Enterprises (PINE). PINE continued negotiations of MOU with TransCanada. Mike Sockalexis, Tribal Energy Coordinator would stay on negotiation team with Yvonne Francis-Ferland, Chairperson of PINE, Greg Sample, Esq., and Attorney for PINE and John Holden, Acting CEO for PINE. **This marks the completion of a major project deliverable number Two under Objective Two, even though the MOU is still being negotiated**.

Penobscot Indian Nation Enterprises (PINE) is a federally chartered corporation created by Penobscot Tribal Council to develop business opportunities for the Penobscot Indian Nation. PINE's legal and political separation from tribal government provides the needed independent business framework necessary for creating proprietary businesses and attracts private sector investments. PINE was given responsibility to negotiate with TransCanada the MOU for predevelopment costs and for developing the investment strategy to acquire 49 per cent ownership of Alder Stream Township Wind Power Project with TransCanada. It is their intention to fund 100% of the Project's Development Costs.

Upon signing of Agreement with CITGO, PIN implemented the 2006 Home Heating Oil Program and because of the use of LIHEAP clients, the program was managed by Erlene Paul, Director of PIN's Human Services and "Reece" Chavaree. The program negotiators included Brenda Fields, Tribal Administrator of Grants and Contracts, James Sappier, Tribal Chief and Mike Sockalexis, Tribal Energy Coordinator, Erlene Paul and Clarice Chavaree, Tribal Human Services. The program will provide discount heating oil to eligible 162 homes on Indian Island for 2006 cool season. Another 50 households meet the lo-income definition utilized by the U.S. Department of Housing and Urban Development. **This completes a second project deliverable number Four under Objective One.**

- Reviewed Wind Power Developers and Energy Audit RFPs and selected the contractor for each project activity.
- Reviewed Technical Assistance RFQ responses and accepted qualified firms.
- Consultants draft, and Energy Project Coordinator and Energy Committee reviews, first draft of Energy Vision/Plan

- Continued meetings with Energy Committee, and Tribal Council as necessary, to review progress
- Energy audit contractor starts/completes review of tribal facilities.
- North Atlantic Energy Advisors and Ed Holt & Associates continue to provide counsel and support to Energy Project Coordinator and Energy Committee on as needed/as requested basis.
- Continued to advice on proposed Alder Stream Township wind project and advice on partner business negotiations with TransCanada.
- TransCanada gave a power point presentation to Tribal Council in March 2006 on Kibby Project and proposed Alder Stream Wind Power Project
- The Nation at its March Monthly Meeting transferred to PINE the project responsibility.
- The Tribal Energy Committee upon selection of developer, recommended in March TransCanada to PINE. PINE will commence negotiations with TransCanada.
- Alan Mulak, PE, spent the week of March 27th assessing the energy efficiency of 13 commercial (tribal) facilities. Mike Sockalexis, Project Coordinator, collected from several sources the facility designs and drawings, especially the electrical and heating source. He arranged meeting and assistance from David Pardilla, Facilities Director and with William Thompson, Air Quality Coordinator for Nation. William will conduct air quality testing in the facilities.

Third Quarter- April 1, 2006 to June 30, 2006:

The Project Activities for this quarter are proceeding accordingly to Grant Proposal. The Energy Audit is near completion. Tribal Council reviewed preliminary results. Doug Baston of North Atlantic Energy, Inc. completed the assessment of renewable energy resources with GIS Mapping of proposed sites. PIN Tribal Energy Committee continued to work on Tribal Energy VISION and Strategic Plan with Consultants Doug Baston and Ed Holt. Ed Holt has continued to provide expertise input in the wind power project.

Progress on the Wind Power Project was delayed briefly because of Lease Permits and Amendment to Tribal Comprehensive Community Plan which called for a Tribal General Meeting and approval to include wind power and granting lease permit. Consultants on hand to give briefings, along with Mike Sockalexis, Energy Project Coordinator and Tim Love, Economic Development Manager and Tribal Attorney, Greg Sample. Conference calls continued with TransCanada regarding MOU and development budget that included PINE expenses for Wind Power Project.

PINE secured Delta Investments CEO/President, Brad Mead to assist in developing financial strategy to purchase 49% ownership in AST Wind Power Project with wind developer, TransCanada, per wind developer's proposal to PIN/PINE.

Mike Sockalexis, Energy Project Coordinator, attended Maine Land Use Regulatory Commission meetings regarding TransCanada application for wind power development at Kibby Township which is adjacent to Alder Stream Township and will continue their progress through the LURC application procedure.

The negotiations of the MOU with TransCanada was delayed because of negotiations with Ultimate Power Company (UPC) for the rights to data and anemometer tower and computer equipment and the cost to TransCanada and PINE to purchase data and equipment at Alder Stream. The original price went from $80,000 to $60, 000 and finally $45,000 because the tower collapsed during high winds this past spring. This basically renders the loss of anemometer tower useless without data. TransCanada agreed to still purchase data and equipment after many conference calls. The Project attorney, Greg Sample drafted the sale agreement and final MOU with UPC. UPC was the previous developer who installed 40 meter anemometer at Alder Stream in 2002. UPC in August 2005 decision to not proceed with Alder Stream Wind Power Project because of their over extend commitments to other wind projects. UPC agreed to convey to PIN/PINE the data and equipment.

The 2006 Home Heating Oil program Agreement has been signed with CITGO and PIN has begun the 2007 program negotiations w/ CITGO. PIN Negotiation Team traveled to New York for final review of 2006 season and then traveled to Venezuela as guest of President Hugo Chavez in April 2006. Because of use of LIHEAP eligible list, confidentiality had to be maintained by having Erlene Paul, Director of Human Services manage the Home Heating Oil Program.

Overall, the four major project deliverables proceeded according to work plan.

- Reviewed Preliminary Results of Energy Audit and begin plan to implement ECM recommendations
- Completed assessment of wind, hydro, biomass and solar potential on tribal trust and fee lands.
- Completed second draft of Energy Vision/Plan, and Energy Project Coordinator and Energy Committee review and comment.
- Continued meetings with Energy Committee, and Tribal Council as necessary, to review progress
- North Atlantic Energy Advisors and Ed Holt & Associates continue to provide counsel and support to Energy Project Coordinator and Energy Committee on as needed/as requested basis.
- NAEA and Holt & Associates continue to advise on proposed Alder Stream Township wind project and advise on partner business negotiations.
- North Atlantic Energy Advisors and Ed Holt & Associates continue to support Nation's efforts in securing information regarding additional public, private, and foundation funding to support their energy-related activities.
- The project is proceeding beyond the current scope of work schedule. With the selection of TransCanada as wind power developer for the Nation, negotiations with them have progressed to the point of development of a Pre-Development Budget PINE and agreed to by TransCanada. TransCanada also agreed to cover costs incurred at anemometer site and data collection to date.

- A draft MOU between Nation and TransCanada is currently being reviewed by attorneys and consultants re: partnership and financing.
- PINE has secured a financial consultant, Brad Mead, CEO/President of Delta Group in Connecticut.
- Doug Baston, North Atlantic Energy is developing map for Wind, Hydro on other PIN Tribal lands, as well as potential biomass sites.
- Ed Holt has provided additional consultant services to the potential Wind Power project and has attended meetings and on conference calls.
- Doug Baston, Consultant has assisted Energy Coordinator in developing funding sources to conduct energy efficiency work as well as grant application for funding from Administration for Native Americans (ANA) for Environmental Regulatory Assessment submitted in March 2006.
- Mike Sockalexis, Energy Project Coordinator, attended several Land Use Regulatory Commission (LURC) meetings regarding regulations and policies governing permitting renewable energy sources in Maine.
- Mike Sockalexis also participated in the negotiations along with Erlene Paul, Director, Clarice Chavaree, HHS, Brenda Fields, Grants and Contracts and Tribal Chief, James Sappier for low home heating oil from CITGO as part of Venezuelan's Discounted Heating oil Program.
- In April 2006, PIN negotiations team traveled to New York and then to Caracas, Venezuela to finalize agreement for 2007 heating season.
- Erlene Paul managed the Home Heating oil Program for the five Maine Indian Communities. Maine Tribes negotiated 950,000 gallons at $1.40/gal.

- Brenda Fields, Erlene Paul, Clarice Chavaree, Mike Sockalexis and James Sappier, Tribal Chief negotiated with State of Maine LIHEAP for the Nation's share of of $5 mil. Appropriated by the Maine Legislature to purchase CITGO Home heating oil. Delegates from the Nation including Mike Sockalexis went to New York City and Washington, D.C. to meet with CITGO President and Venezuelan Ambassador.

Fourth Quarter- July 1, 2006 to September 30, 2006:

The Fourth Quarter is centered on completion of project deliverables and finalization of two major documents of the project: the PIN Strategic Energy Long Term Plan and the Tribal Commercial Energy Audit. The two Consultants, Doug Baston and Ed Holt presented to PIN Tribal Energy Committee and the Chief and Council the **Final VISION/Strategic Energy Plan**, which was accepted and approved. This report was also submitted to Lizana Pierce, DOE Tribal Energy Project Manager in Golden, Colorado. **This completes a project deliverable number One under Objective One.**

Alan Mulak, PE, LLC completed and finalized the **PIN Commercial Facility Energy Audit Study** and submitted his report to PIN Tribal Chief and Council and to the Tribal Energy Committee. This was an excellent detailed report on the need for ECM in the 14 tribal facilities. The report was also sent to DOE Tribal Energy Project Manager, Lizana Pierce in Golden, Colorado. **This completes a major project deliverable number Three under Objective One.**

Mike Sockalexis, PIN Tribal Energy Coordinator, prepared and presented his Final Report in a power point presentation at the 2006 DOE Tribal Energy Program Review in October.

The PIN Negotiation Team met with CITGO to finalize **Agreement for 2007 CITGO Home Heating Oil Program**. This will allow each tribal household on or near Indian island to receive 300 gallons of number one/two home heating oil regardless of income. This will allow more homes to benefit from program than the 2006 season. **This completes a major project deliverable number Four under Objective One.**

The PINE Negotiation Team with Tim Love, Economic Development Manager, Project Attorney, Greg Sample, Project Consultant Brad Mead and John Holden, Acting PINE CEO, met with TransCanada to discuss draft MOU and the status of Alder Stream Wind Power Project. Based on discussions and some agreements, Brad Mead will draft an alternative MOU for review and discussion, as well as a monthly project budget for PINE. Conference call was held internally to discuss draft of MOU by Brad Mead before submission to TransCanada.

This MOU nearly completes the project deliverable number 2 under Project Goal Two. The deadline of December 31, 2006 is the proposed for completion of MOU between PINE and TransCanada.

- Presented Final results of Energy Audit by Alan Mulak to the Tribal Council and develop funding planned to begin implementation of ECM recommendations.

- Presented final draft of the Strategic Energy Plan to the Energy Committee for review and comment in September 2006 by Mike Sockalexis and Consultants.
- Presented final draft of the Strategic Energy Plan to the Tribal council for their review and final approval in July and Final in September 2006.
- Prepared plan, schedule, and financing arrangements to implement audit recommendations.
- Continued to work with the Venezuelan government and CITGO and its agents on bulk oil delivery plan.
- Meeting in New York in October 2006 to sign final home heating oil agreement. Each household will receive home heating oil for 2007 season.
- Continue to coordinate with PINE (Penobscot Indian Nation Enterprises) on development of the Alder Stream/TransCanada wind project.
- Draft MOU with TransCanada and PINE/Nation is being reviewed internally.
- North Atlantic Energy Advisors and Ed Holt & Associates continue to provide counsel and support to Energy Project Coordinator and Energy Committee on as needed/as-requested basis.
- NAEA and Holt & Associates continue to advise on proposed Alder Stream Township wind project and advise on partner business negotiations.
- NAE and Ed Holt & Associates continue to support Tribe in securing additional public, private, and foundation funding to support their energy-related activities.
- Prepared Final Report and power point presentation for October 2006 DOE Tribal programs meeting in Denver.

IDENIFY WORK PRODUCT (S) DEVELOPED AND TECHNOLOGY TRANSFER ACTIVITIES:

***PIN Strategic Plan for Sustainable Energy*: A long-term plan for energy self-sufficiency and sustainable energy development on tribal lands.**

***PIN Commercial Facilities Energy Audit Study*: A Report that makes recommendations, cost savings and conclusions of energy audit conducted at the thirteen (13) largest Tribal Facilities on PIN. The second section of study are the Energy Conservation Measures (ECM) addressing the electric, oil, and gas usage in the facilities.**

PIN 2006 DOE Tribal Energy Program "*First Steps" Energy Grant Review*

Listing of Work Products per Quarter:

First Quarter

1. Contract with North Atlantic Energy Inc. executed
2. Copy of RFQ and RFP for Energy Audit and Wind Power Developer
3. 3-ring Energy Briefing Notebook for Tribal Energy Committee
4. List of Tribal Energy Committee

5. PowerPoint Presentation to Tribal Council October 12, 2005 on Project
6. PowerPoint Presentation at 2005 DOE Tribal Energy Program Review
7. GIS Mapping by Tribal Natural Resource Dept. of Alder Stream Township
8. Initial CITGO Presentation of Home Heating Oil Program

Second Quarter

9. Selected bidders from RFPs and RFQs and compiled list
10. 1st Draft of Energy VISION and Strategic Plan by Consultants
11. Presentation by selected Wind Power Developer to Tribal Council
12. Talking Points w/ Wind Power Developer by Ed Holt, Consultant
13. Alder Stream Township Wind Power Proposal and Development Budget
14. Tribal Council Resolution transferring Wind Power Project to PINE
15. Copy of Initial MOU w/ Wind Power Developer

Third Quarter

16. Preliminary Energy Audit Report by Alan Mulak to Tribal Council
17. 2nd Draft of VISION/Strategic Plan by Consultants
18. Completed Assessment of Renewable Energy resources of Tribal Lands
19. Agreement w/ CITGO for 2006 Discount Home Heating Oil Program

Fourth Quarter

20. Presentation of Final Results of Energy Audit by Alan Mulak
21. Presentation of Final VISION/Strategic Energy Plan by Consultants
22. Agreement w/ CITGO for 2007 Hole heating Oil Program
23. 2nd Draft of MOU w/ Wind Power Developer.

PENOBSCOT INDIAN NATION

LONG -TERM STRATEGIC ENERGY PLAN

PENOBSCOT INDIAN NATION

LONG-TERM STRATEGIC ENERGY PLAN

Department of Energy Award # DE-FG36-05GO15175

Prepared for the
Penobscot Indian Nation

Prepared by
Michael Sockalexis, Energy Program Coordinator
and
North Atlantic Energy Advisors
Ed Holt & Associates, Inc.
for the
Penobscot Indian Nation

August 2006

TABLE OF CONTENTS

EXECUTIVE SUMMARY

The Nation's Strategic Energy Plan is divided into three parts:

I Tribal Energy Vision, Mission and Goals
II Current Energy Status, both current use and potential resource development
III Action Plan to achieve the energy goals

The Tribal Energy Vision provides a description of the Nation's long term energy goals (where it wants to go); the Current Energy Status evaluates existing tribal energy use (where it is now); and the Action Plan identifies options for moving toward achieving the Nation's energy goals (how it will get there).

I TRIBAL ENERGY VISION

The first step in developing an effective strategic energy plan is envisioning your destination. The Penobscot Indian Nation believes that its Energy Vision should go hand-in-hand with other Tribal objectives, like economic development, job creation, and cultural values.

In support of its long-term strategic energy planning effort, as well as its overall mission, the Nation has adopted the following Energy Vision:

> *The Energy Vision of the Penobscot Nation is to maximize the efficiency of energy usage and develop energy resources in ways that will sustain current and future generations by addressing the economic, environmental, and social issues of energy within the context of Penobscot Indian Nation culture, traditions and established tribal policies for the wise use of our forest, water, and wind resources.*

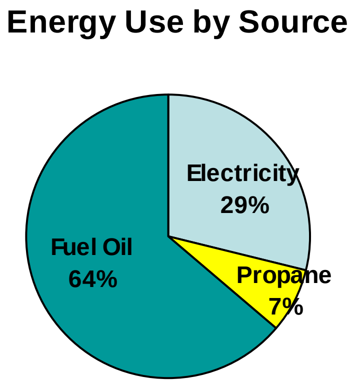
II CURRENT ENERGY STATUS

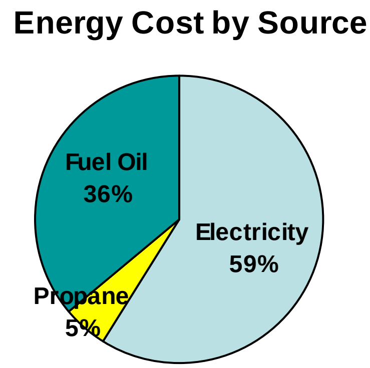
After identifying the Tribe's Energy Vision and Goals, the next step was to understand where the Nation is now. This requires a good understanding of the Nation's current energy status – its energy baseline.

The Nation currently relies on an energy mix of electricity, fuel oil and propane for its facilities and operations. For the year 2005, the Nation's annual energy cost was just over $482,000.

Electricity, supplied to the Nation by Bangor Hydro-Electric Company, accounted for 29% of the Tribe's overall energy use but 59% percent of the total energy costs. Fuel oil, on the other hand, accounted for 64% of energy use but 36% of total energy costs. These comparisons are shown in Table ES-1.

Figure ES-1. Comparison of Energy Use and Energy Cost, by Source





Energy costs could be reduced by 13% by investing in energy efficiency measures in tribal facilities. An investment of $128,000 (after rebates) would save over $64,000 in annual operating costs—a two year payback.

The Nation's current energy demands are expected to continue at a similar level into the near future unless energy efficiency measures are incorporated. Energy costs, however, may well increase with increasing electricity and fuel oil prices.

III ACTION PLAN

Once the Nation developed its energy goals and evaluated its existing energy use, the final step was to identify actions the Nation can implement to move toward achieving its goals. The three primary types of options for moving forward include:

- Energy Efficiency Options
- Energy Generation Options
- Institutional and Administrative Options

Since the Nation began this strategic energy planning effort, some actions discussed below have already begun, and in some cases have already been completed. However, there are a number of additional actions that can keep the Nation moving in the right direction, and that can set certain standards for how strategic energy planning can be incorporated into future development.

A Recommended Energy Efficiency Actions include:

1. Complete a thorough energy audit of all energy use at all tribal facilities and develop a prioritized list of energy efficiency measures.[1]
2. Develop a prioritized plan, including funding, to act on the recommendations contained within the audit.
3. Consider setting aside fuel oil cost savings (or the economic development rebate fund) to pay for energy efficiency capital improvements for tribal facilities or residences.
4. Pursue grants and rebates from USDA and Efficiency Maine to fund most of the costs of these improvements.
5. Incorporate energy efficiency requirements into the design requirements for any new or renovated tribal facilities.
6. Incorporate energy efficiency requirements into procurement policies for any energy consuming devices purchased by the Nation, including office equipment, vehicles, etc.

B Recommended Energy Generation Actions include:

1. Continue to focus on the wind project development at Alder Stream Township to ensure that appropriate environmental and technical studies are completed in preparation for a permitting process, and to identify and pursue capital financing opportunities.
2. Seek grant funding to hire a hydropower consultant to analyze potential small hydroelectric sites in more detail.
3. Evaluate geothermal heat pumps for three facilities after first installing recommended energy efficiency measures.
4. Monitor the market for biomass fuels and consider selling wood waste from Tribal logging operations should market opportunities arise.
5. Consider solar energy when designing and constructing any new facilities.

C Recommended Institutional and Administrative Actions include:

1. Continue to support, and gradually expand, the Nation's energy planning and coordinating staff capabilities and functions.
2. Continue to support the policy-level Energy Committee as the responsible body for energy program oversight and implementation, under the overall direction of the Tribal Council.
3. Seek funding to develop internal tribal regulatory capacity to review the siting and operation of energy generation facilities on tribal lands.
4. Investigate the economic and legal issues involved in establishing a tribal electric distribution utility.
5. Explore opportunities to participate in programs that lower costs by bulk fuel purchasing, such as arrangements with the Venezuelan government and Maine Power Options.
6. Consider adding a green power purchasing component to the Nation's current electric power purchases.

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[1] This action item was completed in April and May, 2006. See Alan R. Mulak, Commercial Facility Energy Audits, Penobscot Indian Nation, Indian Island, Maine, June 8, 2006.

INTRODUCTION

The Penobscot Indian Nation comprises 2,261 members and land holdings of 118,885 acres in various parcels located in northern, eastern and western Maine, as well as access and rights to the waters of the Penobscot Rivers. Tribal lands include other significant waterways, including Sunkize Stream, Pushaw Stream, Birch Stream and the Passadumkeag River.

The Nation is located in a region of North America that has both a cold, harsh climate and high energy costs. Every year the Nation spends thousands of dollars on fuel oil, propane gas and electricity to heat, light and power its public facilities, and individual tribal families expend untold dollars to heat and light their residences. The Nation is also blessed with many natural energy resources. Penobscot lands contain mountains and high ridge lines, large forestry tracts, and access to moving river and stream water, all of which contain latent potential for renewable energy power generation. Jurisdictions to the south are increasingly demanding that clean energy resources be a part of their state energy supplies.

With this as background, the Nation believes that any energy strategy it adopts must achieve two principle goals:

First, it must reduce the cost burden of energy use to the Tribe and its members. To do this the Nation must both explore ways in which to make its existing public facilities and private residences more energy efficient, and examine alternative ways to purchase fuel supplies.

Second, it must address opportunities for sustainable energy production. In doing so the Nation must carefully consider the environmental and cultural impacts of potential sources of renewable energy production, the economic development potential of such activity, and the long-term cost and reliability of each option.

The Strategic Energy Plan is intended to serve as a guide in creating and conducting an effective energy management program for the Penobscot Indian Nation. The plan’s primary objective is to create a long-term sustainable plan for energy self-sufficiency and energy development on tribal lands.

The Strategic Energy Plan is to be used to:

- Identify the current situation relating to energy supply, usage, and cost;
- Provide a structure for updating energy related requirements for the tribal administration and organization;
- Identify opportunities for development of long-term, cost-effective sources of energy; and

- Provide opportunities for tribal members to train and be employed in energy management and energy resource development, operations, maintenance and administration.

With these considerations as preface, the Penobscot Indian Nation Strategic Energy Vision, Mission and Goals follow.

ENERGY VISION, MISSION, & GOALS

A. Energy Vision

The Energy Vision of the Penobscot Indian Nation is to maximize the efficiency of energy usage and develop energy resources in ways that will sustain current and future generations by addressing the economic, environmental, and social issues of energy within the context of Penobscot Indian Nation culture, traditions and established tribal policies for the wise use of our forest, water, and wind resources.

B. Energy Mission

The energy mission of the Penobscot Nation is to aid in the social and economic well-being and development of the Tribe and its members through education about energy matters, conservation of energy resources, and development of environmentally acceptable, culturally appropriate, and economically cost-effective sources of renewable energy.

C. Energy Goals

The two primary energy goals of the Penobscot Nation are to:

1. Reduce energy usage and costs in tribally-owned facilities and in the homes of tribal members;

2. Develop energy resources on tribal lands that create revenues and job opportunities to the Nation, economic development to the region and achieves greater tribal energy self-sufficiency.

These goals will be achieved by pursuing over time the set of objectives and action items that are discussed further into this Plan. First, however, we summarize the current energy status of the Nation, both in terms of energy use and energy resource development potential.

CURRENT ENERGY STATUS

In order to identify the best way to achieve our goals, it is necessary to understand where we are now. This requires that we have a good understanding of the Tribe's current energy status – its energy baseline. In the following sections we first discuss the Tribe's current energy use, energy costs, and environmental impacts. Then we assess the energy resources available for development.

A. Penobscot Nation Energy Use

1. Energy Providers

The Nation currently relies on three different sources of energy to operate its facilities and operations: electricity, fuel oil, and propane. The Nation's electricity is provided by the Bangor Hydro-Electric Company; its fuel oil is purchased from R. H. Foster; and its propane is provided by Amerigas.

2. Tribal Facilities

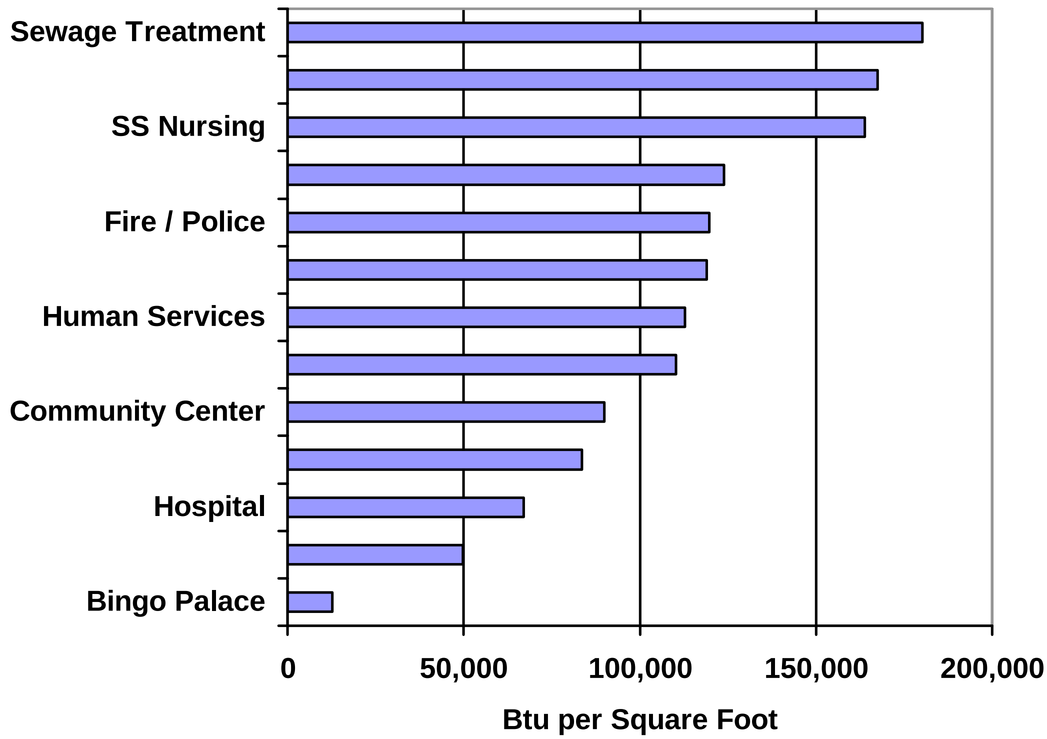
The Nation currently owns and operates a variety of facilities on Indian Island in Old Town, Maine. As shown in Table 1, the largest facility, by square footage, is the Sockalexis Bingo Parlor, followed by the Community Building, Olamon Industries/PIN Rx, and the Indian Island School.

Table 1. Penobscot Facilities Ranked by Area, with Energy Use

Facility	Area sq. ft.	Electricity kWh	Propane gallons	Oil gallons
Sockalexis Bingo	125,000	118,800	-	8,630
Gov / Community	37,109	175,060	-	19,856
Olamon Industries	37,000	166,800	3,067	16,237
Indian Island School	35,800	334,725	-	20,345
Hospital	18,700	164,200	-	5,011
Nick Sapiel Jr.	11,019	262,520	10,373	-
Fire / Police	5,460	42,063	-	3,698
Sewage Treatment	5,000	130,520	-	3,298
Sarah Spring Nursing	3,700	71,000	-	2,637
Human Services	2,200	18,076	-	1,351
Assisted Living	2,100	3,746	-	665
Maintenance Garage	1,800	12,796	-	1,236
Housing Dept	1,700	11,755	-	1,236
Totals	**286,588**	**1,512,061**	**13,440**	**84,200**

Although they are the largest, they are not, however, the most energy intensive. Based on a 2006 energy audit of 13 tribal facilities, the buildings are rank-ordered for energy intensity in Figure 1.

Figure 1. Energy Intensity of Audited Facilities



The most energy intensive facility (measured in British thermal units per square foot[2]) is the sewage treatment facility, primarily because it has a small area and operates around the clock. This is also true with the Sarah Springs Nursing Facility. This is not true, however, for the Nick Sapiel Jr. building. Its relatively high energy intensity for an office building suggests the need for controls and better energy management.

3. Energy Use

The Nation's Facilities Manager maintains data based on monthly utility bills for calendar year 2005. This data is the basis for the evaluation of energy use in this section, as well as the evaluation of energy costs, discussed in the next section.

Electricity

Bangor Hydro-Electric (BHE) provides electrical power to all tribal buildings on Indian Island. In 2005, the Nation used over 1.5 million kilowatt-hours (kWh) of

[2] Converting kilowatt-hours of electricity, gallons of propane and gallons of heating oil to British thermal units or Btu allows for easy comparison using a common unit of energy.

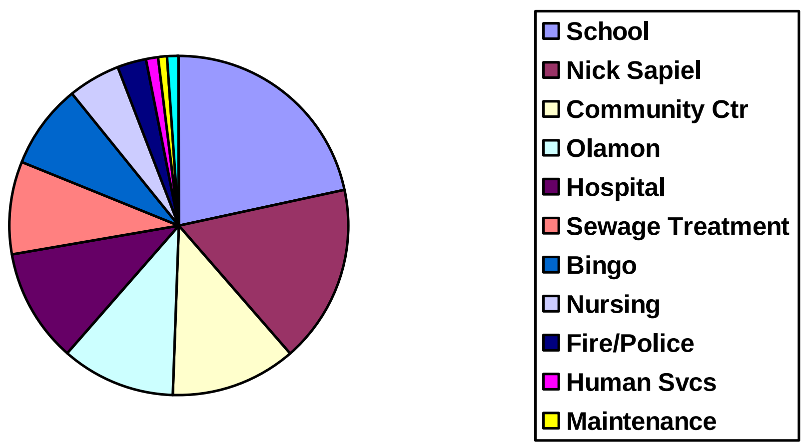
electricity at the 13 audited facilities. About 22% of this total (334,725 kWh) was used at the Indian Island School. Table 2 below displays the annual electricity use of individual tribal facilities for the year 2005.

Table 2. Annual Electrical Use for Tribal Facilities

Facility	Annual Electric Use kWh/year	Percent of Commercial Use
Indian Island School	334,725	22%
Nick Sapiel Jr. Building	262,520	17%
Gov't / Community Center	175,060	12%
Olamon Industries / PIN Rx	166,800	11%
Hospital	164,200	11%
Sewage Treatment Plant	130,520	9%
Sockalexis Bingo Palace	118,800	8%
Sarah Spring Nursing Facility	71,000	5%
Fire / Police	42,063	3%
Human Services	18,076	1%
Maintenance Garage	12,796	1%
Housing Department	11,755	1%
Assisted Living Facility	3,746	0%

Over half of the electricity use is consumed in three buildings, as shown in Figure 1 for the year 2005.

Figure 1. Annual Electrical Use



Fuel Oil

In 2005, R. H. Foster provided fuel oil for heating tribal buildings. The 13 audited facilities used about 84,200 gallons fuel oil. Table 3 below displays annual fuel oil use by each facility.

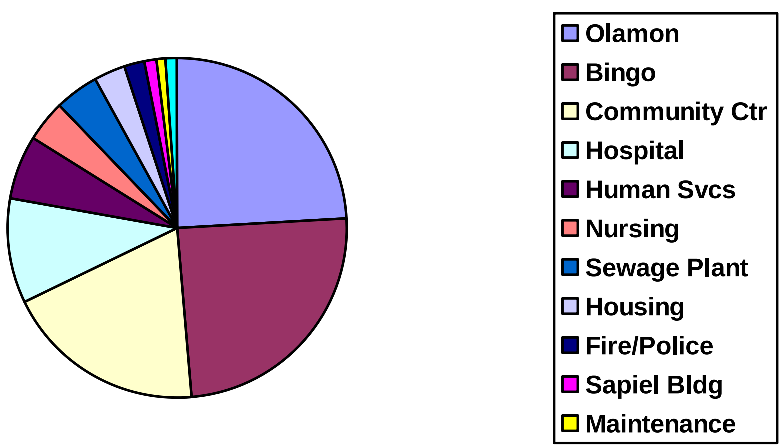
Table 3. Annual Fuel Oil Use for Tribal Facilities

Facility	Annual Oil Use Gallons/year	Percent of Commercial Use
Olamon Industries / PIN Rx	20,345	24%
Sockalexis Bingo Palace	19,856	24%
Gov't / Community Center	16,237	19%
Hospital	8,630	10%
Human Services	5,011	6%
Sarah Spring Nursing Facility	3,698	4%
Sewage Treatment Plant	3,298	4%
Housing Department	2,637	3%
Fire / Police	1,351	2%
Nick Sapiel Jr. Building	1,236	1%
Maintenance Garage	1,236	1%
Assisted Living Facility	665	1%

The Olamon Industries facility used the most, even though it is only half occupied at this time. The Sockalexis Bingo Palace used nearly as much, even though it is used only for events. Clearly there is opportunity to reduce fuel oil use in these facilities.

As shown in Figure 2, over three-quarters of the fuel oil is used in just three facilities—Olamon Industries, the Bingo Palace, and the Community Center, which also houses the Nation's government offices.

Figure 2. Annual Fuel Oil Use



For the 2005-2006 heating season, the Nation was able to obtain a supply of fuel oil at a reduced cost through an agreement with the Venezuelan government and its US marketer Citgo. For the 2006-2007 heating season, the Venezuelan government has agreed to provide fuel oil at a price considerably below current market prices, and in addition has offered to rebate a percentage of the oil payments by the Nation for economic development purposes.

Propane

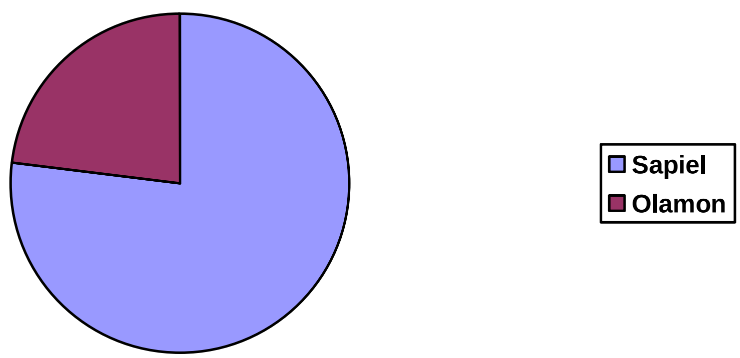
Amerigas supplies propane for heating (including hot water) at two facilities, the Nick Sapiel Jr. office building and the Olamon Industries building now used in part by PIN Rx. As shown in Table 4, the Nation used 13,440 gallons of propane in 2005.

Table 4. Annual Propane Use for Tribal Facilities

Facility	Annual Propane Use gallons/year	Percent of Commercial Use
Nick Sapiel Jr. Bldg.	10,373	77%
Olamon Industries / PIN Rx	3,067	23%

Figure 3 shows that most of the propane is used by the Sapiel Building.

Figure 3. Annual Propane Use



Total Energy Use

To compare the relative contribution of each of the energy sources to the Nation's overall energy use, it is possible to convert each source into an equivalent energy measurement in British thermal units (Btu)

Table 5 displays the Tribe's total energy use by source for the year 2004.

Table 5. 2004 Total Energy Use by Source

Source	Annual Use	Conversion Factor	Equivalent Btu/hr	Percent of Total
Electricity	1,512,061 kWh	3,413 Btu/kWh	5,160,664,193	29%
Fuel Oil	84,200 gal.	138,000 Btu/gal.	11,619,600,000	65%
Propane	13,440 gal.	91,600 Btu/gal.	1,231,135,144	7%
Total			18,011,399,337	100%

Based on the equivalent amount of energy consumed from each energy source, 29% of the Tribe's energy is supplied by electricity, 65% percent is supplied by fuel oil, and 7% percent is supplied by propane.

4. Energy Costs

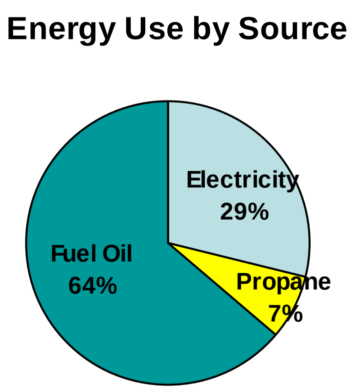
Based on information compiled for the energy audit conducted in 2006, the Nation spent just over $482,000 on energy for the year 2005. A breakdown of energy cost by source is provided in Table 6 below.

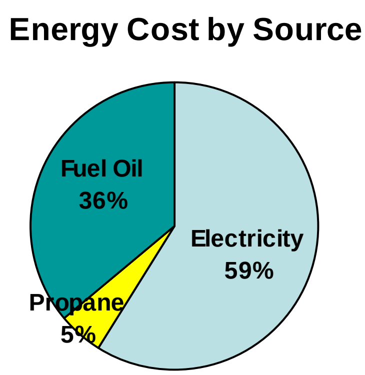
Table 6. Annual Energy Costs

Source	2005 Annual Cost	Percent of Total Energy Cost
Electricity	$287,291	59%
Fuel Oil	$172,610	36%
Propane	$22,580	5%
Total	**$482,481**	**100%**

Although fuel oil is by far the largest energy source on a Btu basis, accounting for 64% of total energy used by the Nation, it drops to 36% as a percent of total energy cost. Electricity, which is only 29% of total use, jumps to 59% of the total cost, as shown in Figure 4.

Figure 4. Comparison of Energy Use and Energy Cost, by Source





Total energy costs (electricity, fuel oil and propane) for individual tribal facilities are displayed in Table 7.

Table 7. 2005 Annual Energy Cost for Tribal Facilities

Facility	Annual Energy Cost	Percent of Total
Indian Island School	$ 105,305	22%
Gov't / Community Center	$ 73,966	15%
Olamon Industries / PIN Rx	$ 70,130	15%
Nick Sapiel Jr. Building	$ 67,306	14%
Hospital	$ 41,471	9%
Sockalexis Bingo Palace	$ 40,263	8%
Sewage Treatment Plant	$ 31,560	7%
Sarah Spring Nursing Facility	$ 18,896	4%
Fire / Police	$ 15,573	3%
Human Services	$ 6,204	1%
Maintenance Garage	$ 4,965	1%
Housing Department	$ 4,767	1%
Assisted Living Facility	$ 2,075	0%
Total	**$ 482,481**	**100%**

Four facilities—the school, the community center, the Olamon building and the Nick Sapiel Jr. building—are responsible for two-thirds of the Nation's energy costs.

The recent energy audits recommended a number of measures that could save the Nation over $64,000 per year (a 13% cost savings) and provide a two-year payback. These improvements require investment capital (after Efficiency Maine rebates) of $128,000, however, and we recommend that the Nation consider setting aside some or all of the cost savings (estimated at $54,000 for the coming year) from purchasing oil from Venezuela (or the rebate fund) and using it to fund the recommended energy efficiency projects. The fund could also be used to pay for efficiency upgrades to homes on Indian Island. There is also a possibility of funding (up to 60% of costs) from the USDA, which should be pursued.

5. Future Energy Use

The existing level and type of energy use by existing tribal facilities is expected to continue into the near future. However, there are plans for additional development on tribal lands that are likely to increase energy demand, including additional residential development of up to 26 homes. There has also been discussion of replacing or updating the Community Center.

B. Penobscot Nation Energy Resources

The analysis of Penobscot energy resources was in part conducted using several digital resource maps available through the federal national laboratory system. In each case, potential resource sites were located and marked on topographical maps of tribal land holdings – reservation, trust and fee lands. The intent was to draw attention to geographic areas of greatest technical potential, and, conversely, to eliminate those areas with no or marginal potential. Areas identified as high theoretical potential, based on the modeling, would require rigorous on-site measurement and analysis in order to verify and quantify the actual resource potential.

1. Hydroelectric Potential

The Nation's potential hydroelectric resources lie in two classes: low to medium-head hydro and high-head hydro.[3] Most existing hydro power installations in the regions where the Penobscot Nation owns land are low to medium head (10 to 100 feet), located either on rivers with large flows or on natural or man-made lakes with large impoundments.

High-head hydroelectric installations do not involve impoundments or dams and therefore involve considerably less capital investment than low-head dams. They also may have lesser environmental impacts than low-head impoundments.

A 1986 assessment of hydro potential indicated that virtually all sites with any reasonable potential for low-head hydro-electric development had been identified and reserved through preliminary licensing applications with the Federal Energy Regulatory Commission as of 1980.[4] Although a developer may pursue licensing of sites that they do not own, the assessment states that "The land holdings of the Penobscot Nation (except for islands in the Penobscot River) do not appear to have sufficient water resources for low-head hydro-electric power generation. Those lakes, ponds or rivers on or near the Nation's lands with any economic potential have already been developed."[5]

On the other hand, the 1986 assessment is more positive about the potential from high-head hydropower. Relying on an analysis of topographical maps, the assessment identified 18 potential sites on or near the Tribe's fee and trust lands, with a total capacity of 1.7 MW.

For this Energy Plan, we consulted new hydrographic models created by the Idaho National Energy Laboratory (INEL) using national level data and analysis.[6]

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[3] "Head" is the height from water surface to the turbines in the power plant. The quantity of electricity generated is determined by the volume of water flow and the amount of head. The greater the flow and head, the more electricity produced.

[4] Penobscot Indian Nation Comprehensive Plan, Economic Development Component (authors unstated), 1986. Although the economics are out of date, this assessment should be consulted before pursuing additional hydro development.

[5] Ibid. p. 118.

[6] Douglas G Hall, Kelly S. Reeves, Julie Brizzee, Randy D. Lee, Gregory R. Carroll, Harold L. Sommers. "Feasibility Assessment of the Water Energy Resources of the United States for New Low Power and Small Hydro Classes of Hydroelectric Plants," Idaho National Laboratory, January 2006.

Criteria used by INEL to screen and assess potentially developable local sites included:

- Site accessibility, proximity to existing transmission infrastructure, and the absence of development;
- Implementation of only low power or small hydro projects that would not create a reservoir or impound the total stream; and
- Power production that would capture no more than half of the annual mean flow.

The INEL model was used in conjunction with the Webgis program found at http://hydro2.inel.gov/prospector to identify sites on Tribal lands. The resulting maps are shown in Appendix A.

Power for a specific site was estimated by looking at annual mean power, not the hydropower capacity. All the potential sites identified are indicated to be "low power sites," meaning they are capable of producing less than 1 average megawatt (MWa).[7] A visual inspection of the maps suggests a total of about 20 MWa on tribal lands. These are summarized by location in Table 8.

Table 8. Potential Sites for Hydro Development on Penobscot Lands

Location	No. of Sites x Est. Mean Power
Alder Stream	7 x 0.0 – 0.5 MWa 2 x 0.5 – 1.0 MWa 1 x 1.5 – 2.0 MWa
Alton	4 x 0.0 – 0.5 MWa
Argyle	6 x 0.0 – 0.5 MWa
Carrabassett Valley	6 x 0.0 – 0.5 MWa 3 x 0.5 – 1.0 MWa 1 x 1.5 – 2.0 MWa
Lakeville	5 x 0.0 – 0.5 MWa
Matagamon	none
Mattamiscontis	9 x 0.0 – 0.5 MWa
T1R6	5 x 0.0 – 0.5 MWa
T2R8	5 x 0.0 – 0.5 MWa 1 x 0.5 – 1.0 MWa
T3R1	1 x 0.0 – 0.5 MWa
Williamsburg	2 x 0.0 – 0.5 MWa

This modeling and mapping suggest more hydropower potential than was estimated for the comprehensive plan 20 years ago. In addition, there are relatively new technologies for application in small mountain streams, and energy prices and electric industry structure have changed significantly in the last 20 years. Before deciding whether to proceed with development at any of these

[7] An average MW is a megawatt of capacity that operates continuously, or has a capacity factor of 100%, although in reality each generating unit has different capacity factors.

sites, however, further engineering, economic and environmental analysis would be required.

We recommend that the Nation secure a grant to study these potential hydroelectric sites in more detail. With this grant, the Nation would hire a hydropower consultant to review the most recent data, review the most recent hydroelectric technology for in-stream power generation, conduct some preliminary economic and technical feasibility analysis, and recommend priority sites for development.

Penobscot River Restoration Project

Although it is not a new hydro development opportunity, we would be remiss if we did not mention the Penobscot River Restoration Project. The Project is a roadmap for the river basin that will:[8]

- Restore self sustaining populations of native sea-run fish, such as the endangered Atlantic salmon, through improved access to over 500 miles of historic habitat;
- Renew opportunities for the Penobscot Indian Nation to exercise sustenance fishing rights;
- Create new opportunities for tourism, business and communities;
- Resolve longstanding disputes and avoid future uncertainties over the regulation of the river.

Partners in the Penobscot River Restoration Project have negotiated an agreement that will redefine the Penobscot River over the coming years by allowing:

- The Penobscot River Restoration Trust, a non-profit entity formed in May, 2005, the option to purchase three dams from PPL Corporation, removing two of them (Veazie and Great Works) and decommissioning a third (Howland) while improving fish passage;
- PPL Corporation the opportunity to increase generation at six existing dams, which would result in more than 90% of the current energy generation being maintained;
- PPL Corporation to improve fish passage at four additional dams.

Partners in the agreement, which must be approved by the Federal Energy Regulatory Commission (FERC), include the dam owners, PPL Corporation, the Penobscot Indian Nation, American Rivers, Atlantic Salmon Federation, Maine Audubon, Natural Resources Council of Maine, Trout Unlimited, the U.S. Department of Interior's Bureau of Fish and Wildlife, Bureau of Indian Affairs, and the National Park Service, and four State of Maine natural resource agencies –

[8] Information on the Penobscot River Restoration Project is taken from http://www.penobscotriver.org.

the State Planning Office, the Department of Natural Resources, the Department of Inland Fisheries and Wildlife, and the Atlantic Salmon Commission.

Implementation of this unprecedented project – reconfiguration of the hydropower projects on the Penobscot River – will take time.

- One of the first things to occur is that PPL Corporation will apply to FERC and the Maine Department of Environmental Protection for energy increases at West Enfield, Orono and Stillwater.
- PPL Corporation will also begin to address impacts of energy operations on tribal lands.
- Following the signing of the final agreement on June 25th, 2005, the Penobscot River Restoration Trust -- a Maine 501(c)(3) not-for-profit corporation created by the conservation groups and the Penobscot Indian Nation -- has a 3-5 year option period during which time the dams must be purchased. The Trust will work with other interested parties to raise, from state, federal, and private funds, the $25 million needed to purchase the Veazie, Great Works and Howland Dams and also to raise the subsequent funding to implement the removals, alterations, mitigation and economic development elements of the project.
- With FERC's approval, the relicensing of the Howland and Great Works dams will be put on hold for five years to provide the opportunity for successful implementation of the project.
- Preliminary engineering work for removal of the Veazie and Great Works Dams and for the Howland bypass option is underway.
- The filing of the agreement with FERC also signifies the beginning of the federal and state regulatory process for the project, during which the public will have multiple opportunities to comment.

The three dams that will be purchased as part of the option agreement will not be altered or removed until sometime between 2006-2010.

2. Biomass Resource Potential

The Penobscot Nation has land resources of almost 120,000 acres, almost all heavily forested. The Nation manages this timberland under a long term sustainable management plan, developed through an extensive process that included broad tribal member input and support. The primary goals of this plan are sustainable timber harvesting and cultural and wildlife enhancement and preservation. Forest growth on the Nation's lands has a much higher value for pulp logs, and to a lesser extent for saw logs. Forest growth for biomass energy production is of much lower value. Thus, production for the primary purpose of biomass fuel is not, and will not be, a part of the Nation's forestry future. Management for the higher uses identified does produce some wood waste that could potentially serve as biomass fuel stock, but this byproduct by itself would not provide the foundation for an economically viable biomass electricity generation station.

Thus, any examination of biomass as an energy resource properly belongs in the realm of tribal economic and employment development strategies[9] that involve fuel stocks generated primarily from non-native land sources, a discussion that is beyond the scope of this Plan.

It is worthy of note, however, that new markets for renewable energy in southern New England, a federal production tax credit, and advances in conversion technologies have revived interest in this method of electricity production, and all of Maine's existing biomass plants are currently running at full capacity.

As part of its ongoing forestry management practice, the Nation should monitor the market for biomass fuels and consider selling wood waste from its logging operations should market opportunities arise.

3. Wind Energy Potential

Potential wind development sites are still being explored, although one site in particular is now the subject of development work. For the Strategic Energy Plan, wind development potential was assessed using data received from the National Renewable Energy Laboratory (NREL) in Golden, Colorado. This data was developed by TrueWind Solutions with their "Mesomap" system using historical weather data.[10]

The wind maps of tribal lands are included in Appendix B. These maps do not estimate power generation potential, but they do indicate, by color, the most promising wind sites for more detailed analysis. Clearly, and not surprisingly, the most promising wind energy potential areas are in the western Maine mountains – specifically in Alder Stream Township (trust land) and Carrabassett Valley (fee land).

The Alder Stream Township Wind Project

One potential wind power stands out from among the sites identified above by virtue of: (1) the scale of its potential; (2) the level of detailed analysis conducted at the site; and (3) the immediacy of a potential commercial development possibility.

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[9] A 2002 New Hampshire study found that a biomass station employs about 20 people at the plant and supports another 50 in the woods.

[10] Based on modeling assumptions, the TrueWind analysis produces estimated annual average wind resource potential for the State of Maine at a 50 meter height. The national level analysis was commissioned by the Massachusetts Technology Collaborative, in conjunction with the Connecticut Clean Energy Fund and Northeast Utilities, and the were validated by NREL. However, the data is not suitable for micro-siting potential development projects. The maps of Penobscot lands shapefile was generated from a raster dataset with a 200 m resolution, in a UTM zone 19 datum WGS 84 projection system.

The Alder Stream wind site is located in northern Franklin County, Maine, about fifteen miles from the Canadian border within a 35 square mile township held in Trust for the Nation by the federal government. The township is currently managed by the Nation for commercial forestry and recreation.

From September, 2003 to August, 2005 the Nation had an agreement with a wind developer to develop a wind project on the site. During that two-year period, the developer maintained a 40-meter meteorological tower installed at an elevation of 2879 feet. The data collected and recorded from that tower shows average sustained wind speed in excess of 18 mph.

In August 2005, this original developer made a corporate decision to consolidate its resources and focus it efforts on developing other projects, and allowed its agreement with the Nation to lapse. The Nation then issued an RFP for a wind development partner and, as this is written, is finalizing an agreement with the selected developer.

The original capacity estimate was that 100-200 MW of wind power generation could be installed on this site. A more recent estimate from the second developer is that perhaps 30 MW can be economically installed. Sites for Individual turbines, though very windy, might be too costly to develop in the rugged terrain, leading to a lower estimate of potential. Additional data collection and environmental studies are now being undertaken.

Our recommendation is that the Tribe continue its focus on the development at Alder Stream Township, ensuring that appropriate environmental and technical studies are completed in preparation for a permitting process.

4. Geothermal Energy Potential

Electricity from geothermal resources deep below the earth's surface requires very hot water or steam, but these resources exist primarily in the western United States. Maine has low to moderate temperature resources that are less suited to electricity generation but that can be tapped for direct heat or for geothermal heat pumps.[11]

[11] According to the Geothermal Energy Association, recent advances in geothermal technology have made possible the economic production of electricity from lower temperature geothermal resources, at 100o C (212o F) to 150o C (302 o F). In what are known as "binary plants," the geothermal water heats another liquid, such as isobutane, that boils at a lower temperature than water. The two liquids are kept completely separate through the use of a heat exchanger used to transfer the heat energy from the geothermal water to the "working-fluid." The secondary fluid vaporizes into gaseous vapor and (like steam) the force of the expanding vapor turns the turbines that power the generators. While Maine has temperatures estimated at 150-200 degrees C, accessing these temperatures would require drilling to a depth of 6 kilometers

The most likely geothermal application for the Tribe is the geothermal heat pump, also known as the ground source heat pump. It can be a very efficient means to provide heating and cooling to some facilities. Geothermal heat pumps are similar to ordinary heat pumps, but use the ground instead of outside air to provide heating, air conditioning and, in most cases, hot water. Their renewable advantage is that they work by concentrating naturally existing heat, rather than by producing heat through combustion of fossil fuels.

The technology relies on the fact that the earth (beneath the surface) remains at a relatively constant temperature throughout the year, warmer than the air above it during the winter and cooler in the summer, very much like a cave. The geothermal heat pump takes advantage of this by transferring heat stored in the earth or in ground water into a building during the winter, and transferring it out of the building and back into the ground during the summer. The ground, in other words, acts as a heat source in winter and a heat sink in summer.

In fact, a recent audit of tribal facilities on Indian Island recommended that the Tribe look into geothermal heat pumps for potentially three facilities—the Nick Sapiel Jr. Building, the Olamon Industries building, and the sewage treatment plant.[12] The audit report noted, however, that all three facilities should first take an aggressive approach to energy efficiency and reduce energy consumption as much as practical.

5. Solar Energy Potential

Solar energy is generally expensive compared to power purchased from the utility grid, but it may be very cost-effective for off-grid applications as an alternative to the expense of bringing a distribution line to a site. With on-grid applications, solar projects can serve an educational function if undertaken at a highly visible site such as a school or other community building. A number of communities across the United States that have installed solar photovoltaic systems on their schools have incorporated solar energy into the school curriculum.

Commonly known as *solar cells*, individual photovoltaic (PV) cells are electricity-producing devices made of semiconductor materials. PV cells come in many sizes and shapes — from smaller than a postage stamp to several inches across. For building applications, they are connected together to form larger PV *modules* that may be up to several feet long and a few feet wide. Modules, in turn, can be combined and connected to form PV *arrays* of different sizes and power output.

The size of an array depends on several factors, such as the amount of sunlight available in a particular location and the power needs of the user. The modules of the array make up the major part of a PV *system*, which can also include

[12] Alan R. Mulak, Commercial Facility Energy Audits, Penobscot Indian Nation, Indian Island, Maine, June 8, 2006.

electrical connections, mounting hardware, power-conditioning equipment, and batteries that store solar energy for use when the sun is not shining.

PV systems can go on a rooftop or be mounted on a column, and sometimes (especially with new buildings) may be integrated into building materials such as glass, roofing shingles or flat-roof insulation.

Maine has a moderate solar potential as shown by the two maps in Appendix C.

We recommend that the Nation consider solar energy whenever it undertakes construction of a new facility, whether on-grid or off-grid. If the Nation is planning to erect a permanent structure that is remote from existing power lines, it should consider solar for an energy source.

INSTITUTIONAL CAPACITY

Energy Project Manager

The Nation currently employees a part-time (18-34 hours per week) Energy Project Manager, funded out of federal grant funds from the US Department of Energy. Given the opportunities and challenges facing the Tribe, as outlined in this Plan, this position should be continued at least at the current level in the near term.

Energy Committee

To ensure that this Plan has the broadest possible support within the Penobscot Nation, and that the Action Plan is implemented with appropriate direction and policy oversight, the Energy Committee should be continued with its current mission and structure. The Committee has been charged by the Chief and Council with the responsibility of developing all internal tribal energy policy and management capabilities, as well as with the selection and oversight of any contractors or experts engaged to assist in the development of tribal energy policy and regulations. The Energy Committee consists of the Nation's Directors of Economic Development, the Department of Natural Resources, and the Department of Trust Resources, as well as the Nation's Administrative Officer and one member of the Tribal Council. The Nation's Energy Project Director chairs the committee.

Regulatory Capacity

The Nation should also develop a regulatory and technical capability, through creation of an oversight entity, to monitor the development of energy projects and to oversee ongoing power generation at developed sites. This includes developing the internal capability – both administrative and technical – to conduct environmental assessments and set forth developmental conditions based on their results. It also includes organizational development, staff selection, and staff development and staff training components. Implicit in this task is a determination of the legal relationship between the authority of the State of Maine and the authority of the Penobscot Indian Nation with regard to regulation of energy and environmental projects on Penobscot Tribal, Trust and Fee lands. The pendancy of the Alder Stream Project, discussed above, gives a particular urgency and priority to completion of these tasks.

Tribal Electric Distribution Utility

Currently, dollars spent to heat and light tribal facilities, and the homes of tribal members, are expenditures that create no economic value for the Nation. Utility bill payments flow out of the community. These are diverted funds that would otherwise be retained within the Tribe where they would be applied to activities that create either internal economic activity or goods and services for export to off-reservation buyers. Indigenously produced energy should also be used, either directly or indirectly, to help offset current high energy costs and support tribal economic development, and the Nation's regulatory framework should facilitate this. For these reasons, the Nation should research the legal, institutional, and economic viability of establishing a tribally-owned electric distribution utility.

ENERGY ACTION PLAN

As a result of its analysis of the above data and plan recommendations, the Penobscot Energy Committee recommends the following actions for immediate attention.

Recommended energy efficiency actions include:

1. Complete a thorough energy audit of all energy use at all tribal facilities and developing a prioritized list of energy efficiency measures.[13]
2. Develop a prioritized plan to act on the recommendations contained within the audit. Recommended energy efficiency measures could save the Tribe over $64,000 per year and provide a two-year payback.
3. Consider setting aside cost savings (estimated at $54,000 in the coming year) on fuel oil from Venezuela (or the economic development rebate fund) to pay for energy efficiency capital improvements.
4. Apply for grants and rebates from the USDA (60%) and Efficiency Maine (35%) to pay for a majority of capital costs.
5. Incorporate energy efficiency requirements into the design requirements for any new or renovated tribal facilities.
6. Incorporate energy efficiency requirements into procurement policies for any energy consuming devices purchased by the Nation, including office equipment, vehicles, etc.

Recommended energy generation actions include:

1. Continue to focus on the wind project development at Alder Stream Township to ensure that appropriate environmental and technical studies are completed in preparation for a permitting process, and to identify and pursue capital financing opportunities.
2. Seek grant funding to study potential small hydroelectric sites in more detail. With this grant, the Nation should hire a hydropower consultant to review the most recent data, review the most recent hydroelectric technology for in-stream power generation, conduct preliminary economic and technical feasibility analyses, and recommend priority sites for development.
3. Evaluate geothermal heat pumps for three facilities—the Nick Sapiel Jr. Building, Olamon Industries, and the sewage treatment plant. First, however, energy efficiency should be pursued aggressively in all three facilities to reduce energy use as much as practical.

[13] This action item was completed in March and April, 2006. See Alan R. Mulak, Commercial Facility Energy Audits, Penobscot Indian Nation, Indian Island, Maine, June 8, 2006.

4. Monitor the market for biomass fuels and consider selling wood waste from its logging operations should market opportunities arise.
5. Consider solar energy whenever construction of a new facility is undertaken. If the Nation is planning to erect a permanent structure that is remote from existing power lines, it should consider solar for an energy source.

Recommended institutional and administrative actions include:

1. Assign staff who will be responsible for coordinating and implementing energy planning efforts.
2. Continue to support the policy-level Energy Committee as the responsible body for energy program oversight and implementation, under the overall direction of the Tribal Council.
3. Develop a regulatory framework, and the administrative capacity to implement it, that will allow for orderly, balanced, environmentally sound, and economically sustainable development of renewable energy resources on tribal lands.
4. Produce a coherent and organized set of regulations, which, properly administered, will balance the above objectives.
5. Secure and develop staff for the new regulatory entity.
6. Establish a funding mechanism to sustain the entity independent of federal funding.
7. Investigate the economic and legal issues involved in establishing a tribal electric distribution utility.
8. Explore opportunities to participate in programs that lower costs by aggregating many customers into bulk fuel purchasing cooperatives, such as Maine Power Options.
9. Consider adding a green power purchasing component to the Tribe’s current electric power purchases.

APPENDIX A: HYDROELECTRIC POTENTIAL MAPS

Alder Stream hydro

Alder Stream hydro contours

Alton hydro

Argyle hydro contours

Carrabassett Valley hydro

Carrabassett Valley hydro contours

Lakeville hydro

Lakeville hydro contours

Matagamon hydro

Matagamon hydro contours

Mattamiscontis hydro

Mattamiscontis hydro contours

T1R6 hydro

T1R6 hydro contours

T2R8 hydro

T2R8 hydro contours

T3R1 hydro

T3R1 hydro contours

Williamsburg hydro

Williamsburg hydro contours

APPENDIX B: WIND POWER POTENTIAL MAPS

Wind Potential GIS maps were created using ESRI Arcmap version 8.1. Tribal lands data layers were obtained from Binke Wang. These layers include: streams, rivers, ponds, roads, contours, and Tribal land boundaries. Wind Potential data layer was obtained from US Department of Energy, National Renewable Energy Laboratory (http://www.nrel.gov/gis/).

Alder Stream

Alder Stream, Round Mountain (this is a close-up of the joint PIN/TC site)

Alton

Argyle

Carrabassett Valley

Carrabassett Valley - Poplar Mtn (close-up)

Carrabassett Valley - Sugarloaf Mt. (another close-up)

Lakeville

Matagamon

Mattamiscontis

T1R6

T2R8

T3R1

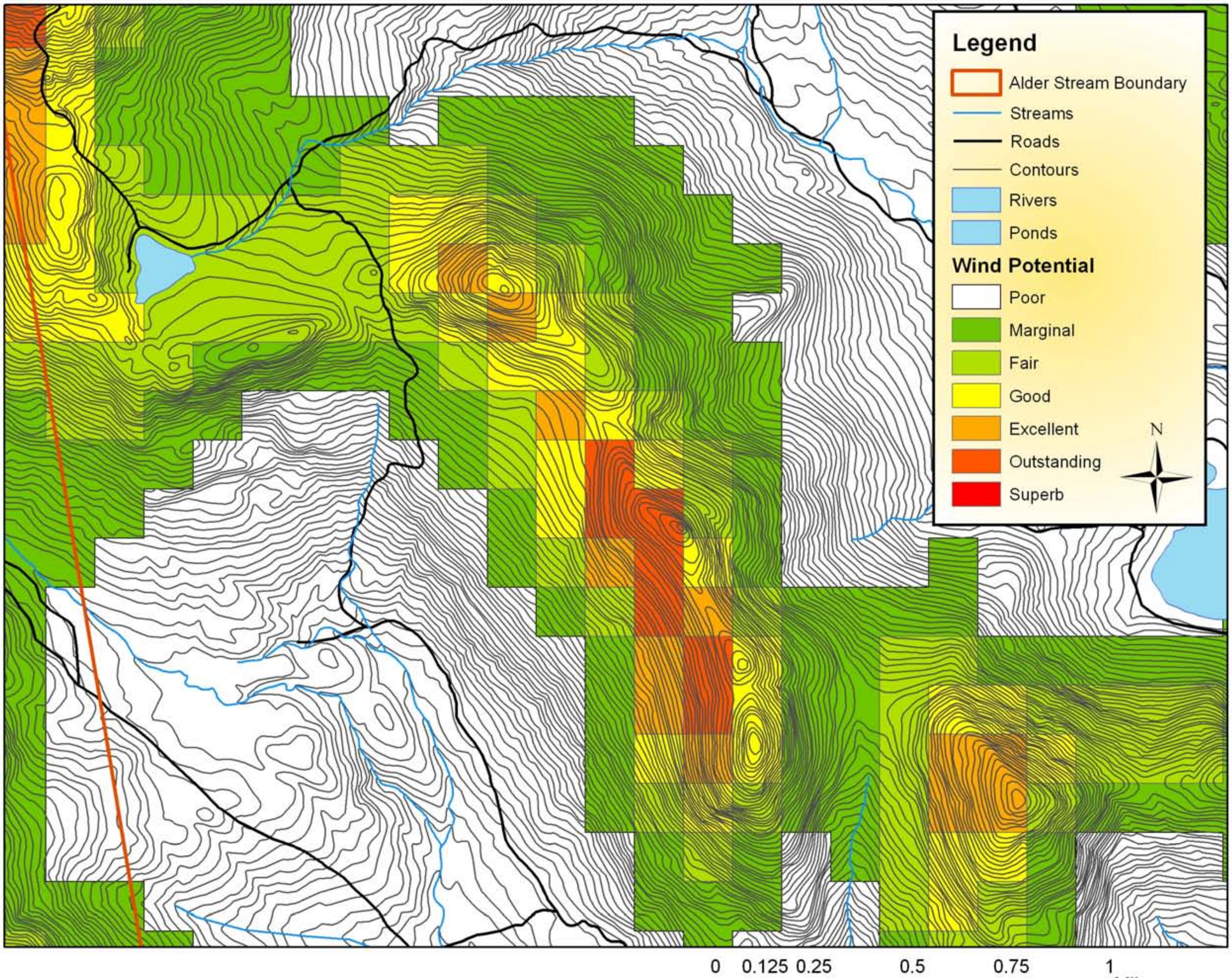
Williamsburg

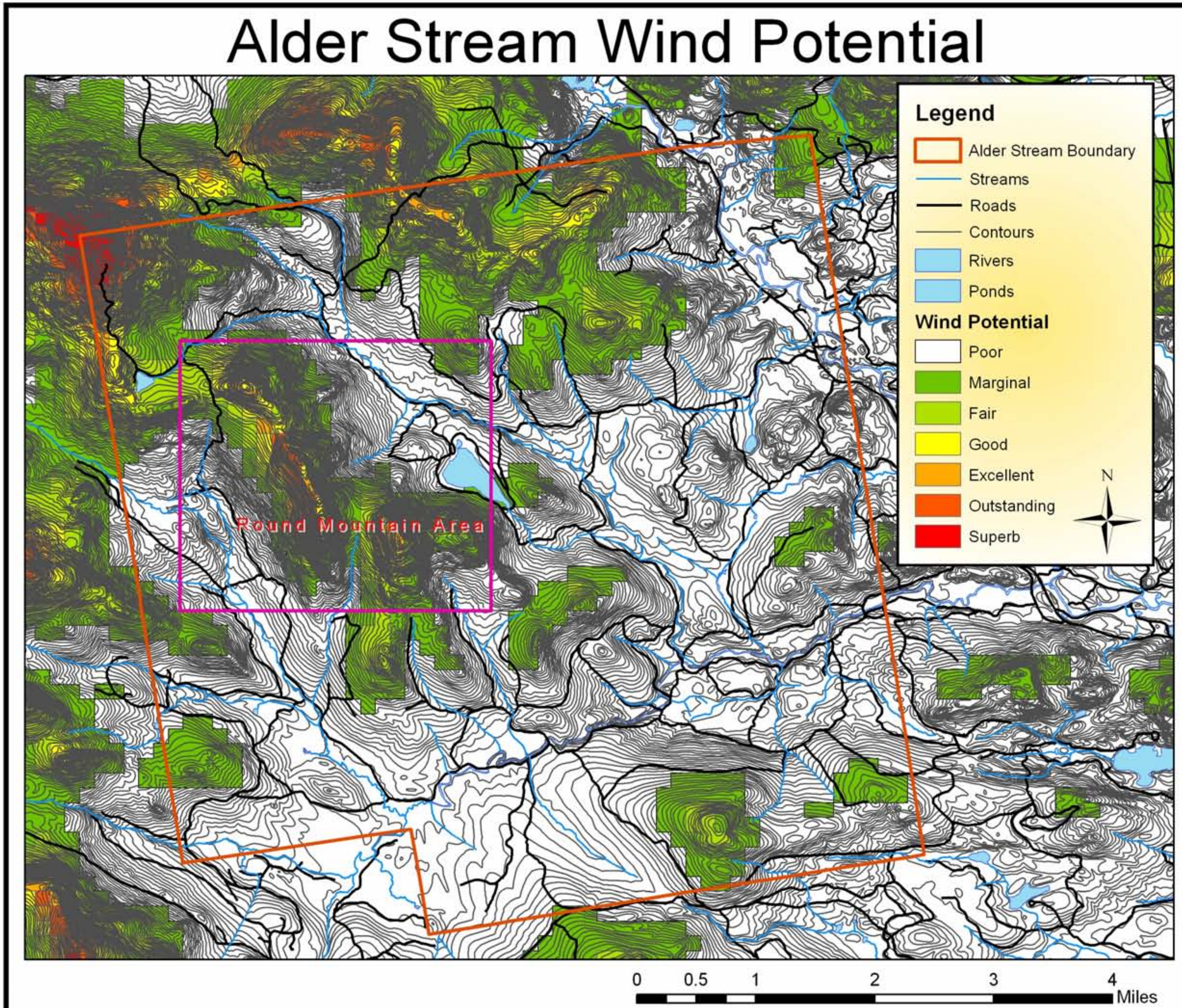
APPENDIX C: SOLAR ENERGY POTENTIAL MAPS

Maine direct normal solar potential

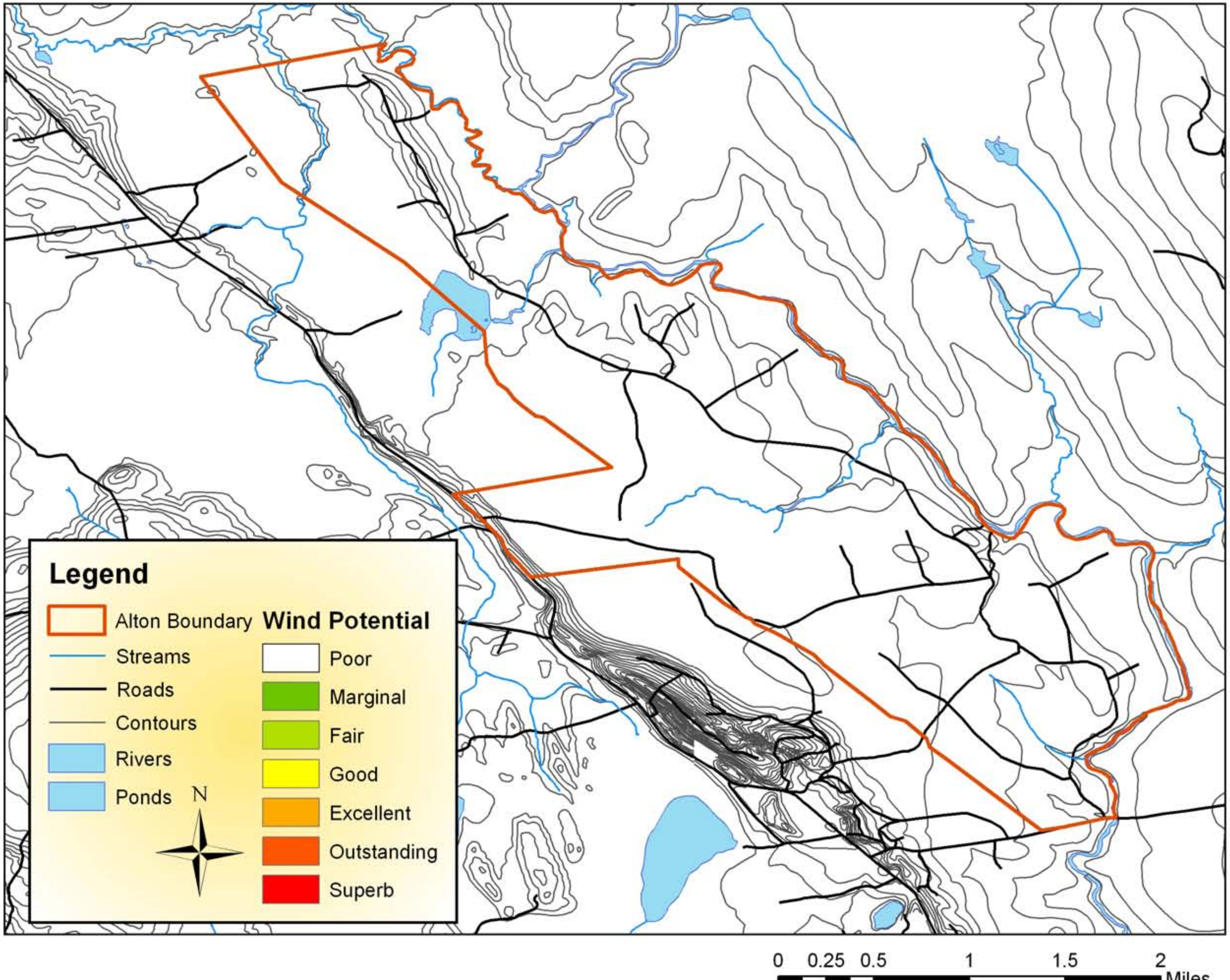
Maine PV solar potential

Alder Stream - Round Mtn. Wind Potential

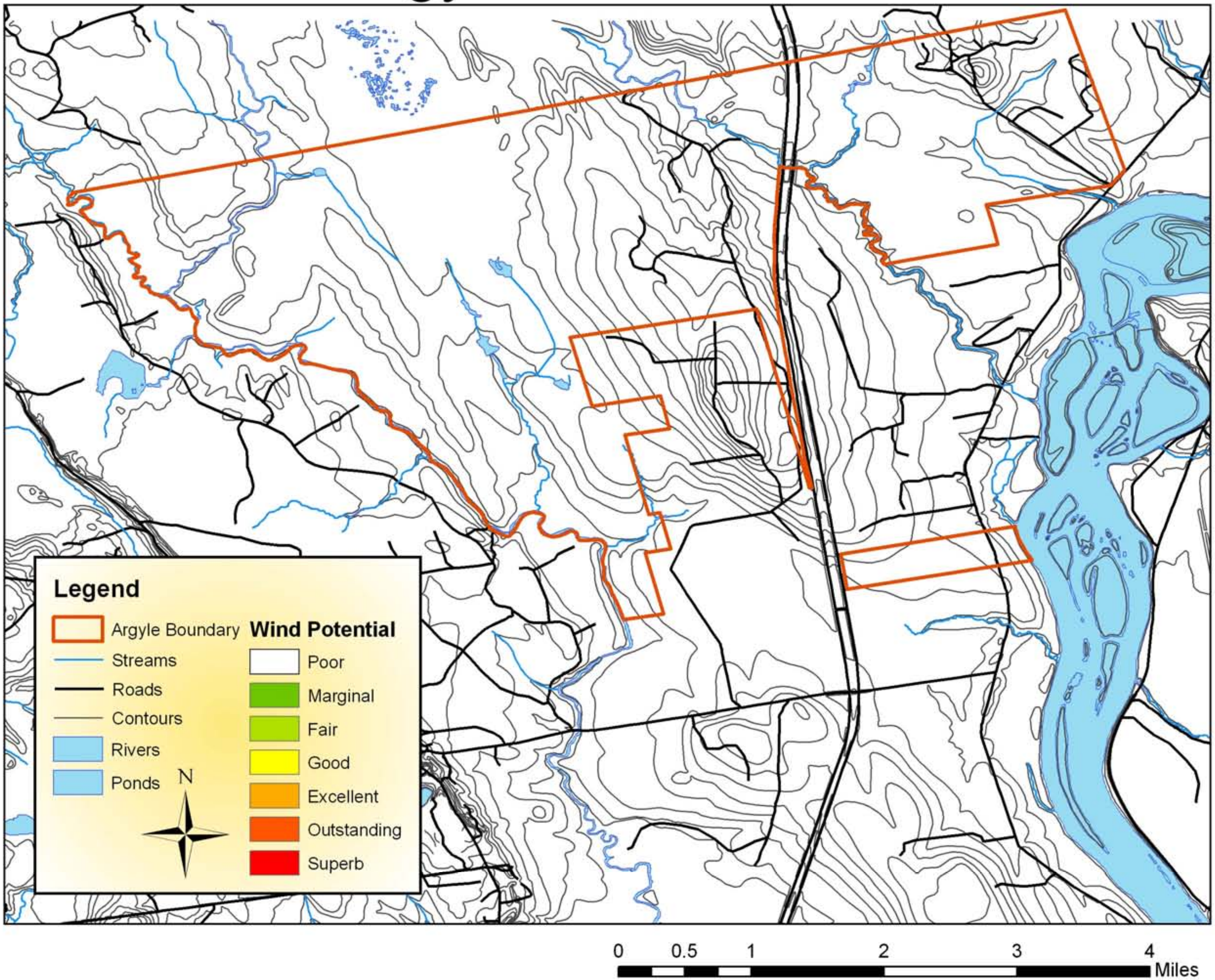


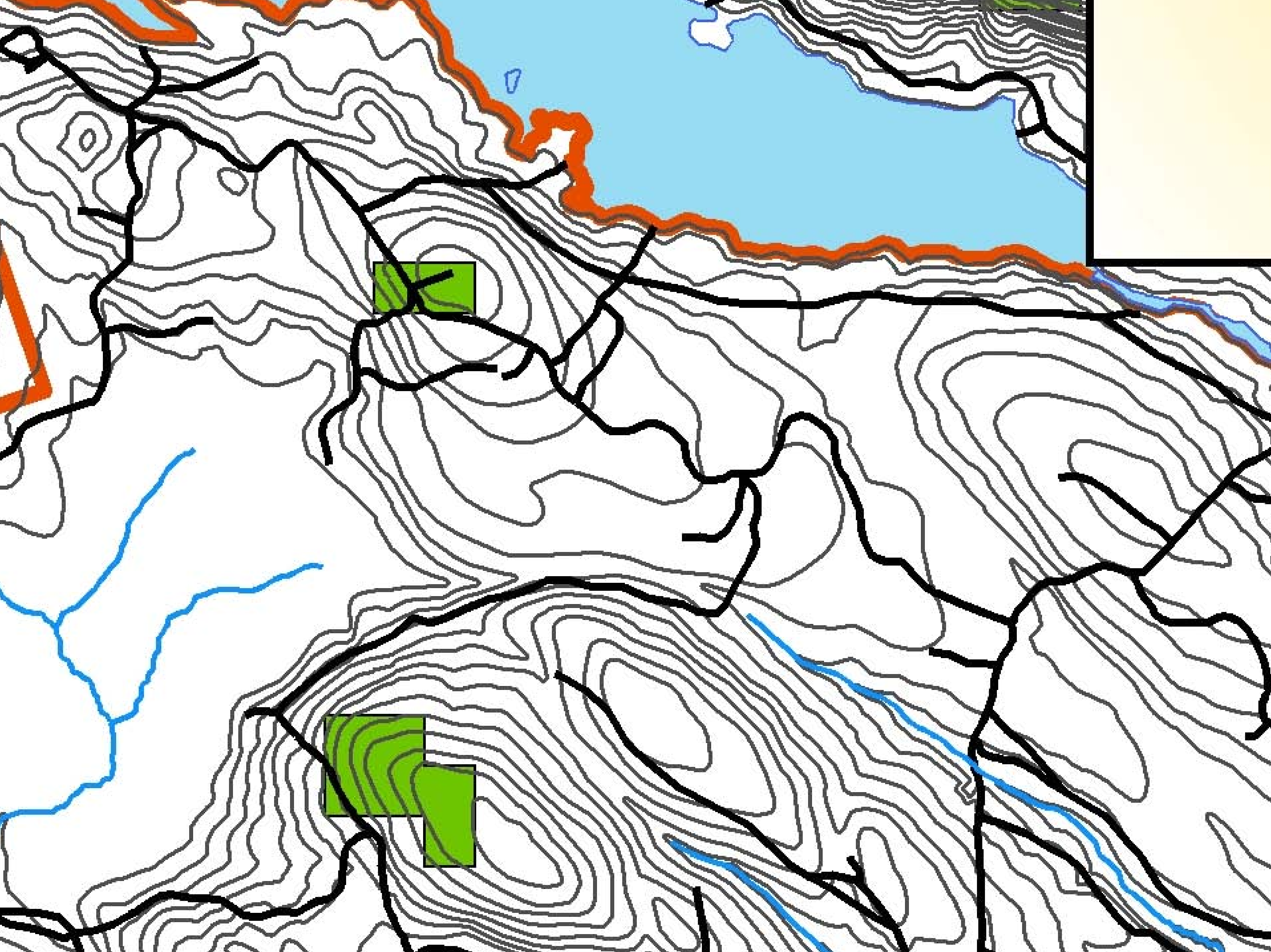

Alder Stream Wind Potential
Legend
Alder Stream Boundary
Streams
Roads
Contours
Rivers
Ponds
Wind Potential
Poor
Marginal
Fair
Good
Excellent
Outstanding
Superb
N
Round Mountain Area
0
0.5
1
2
3
4
Miles

Alton Wind Potential

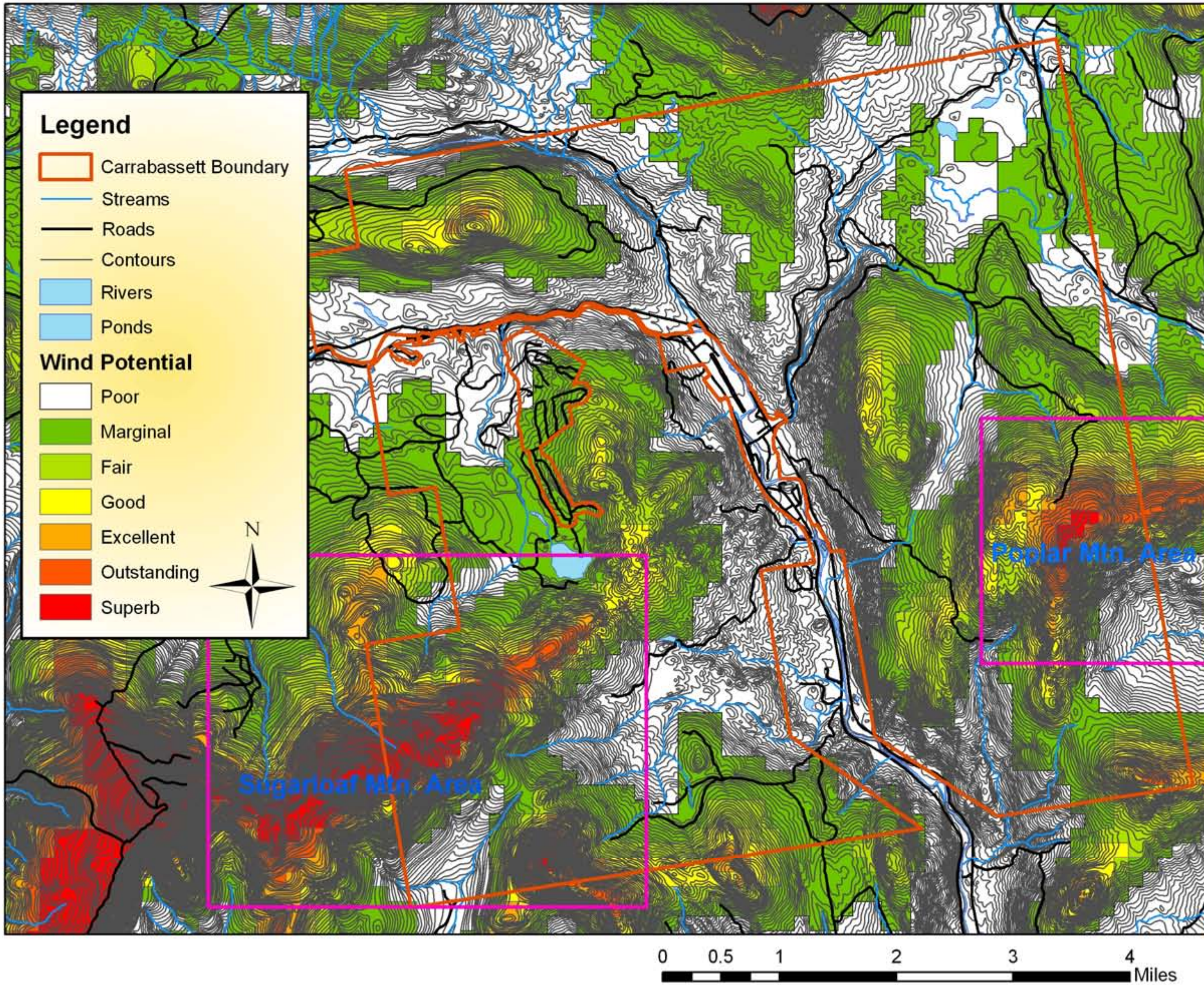


Argyle Wind Potential

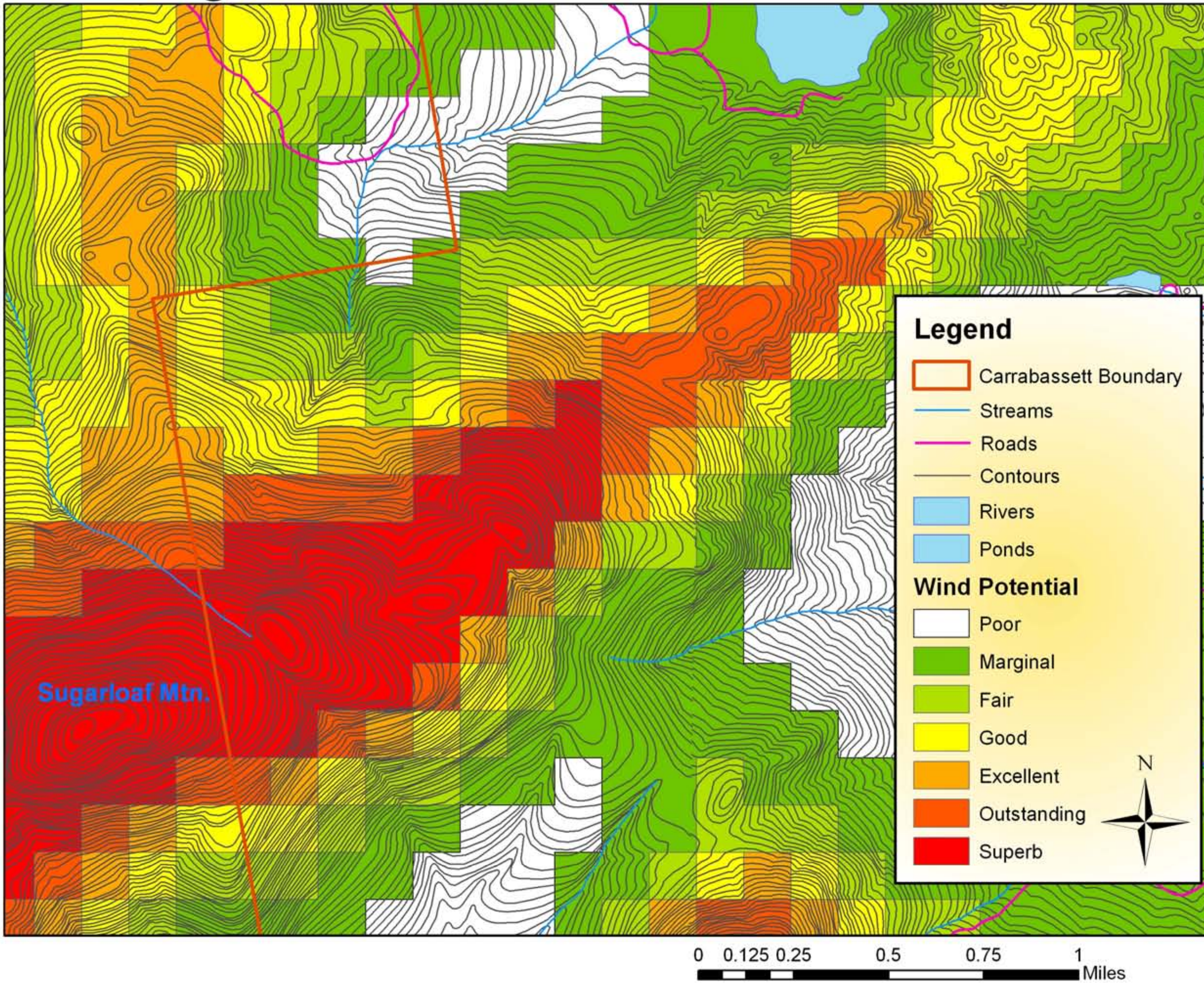




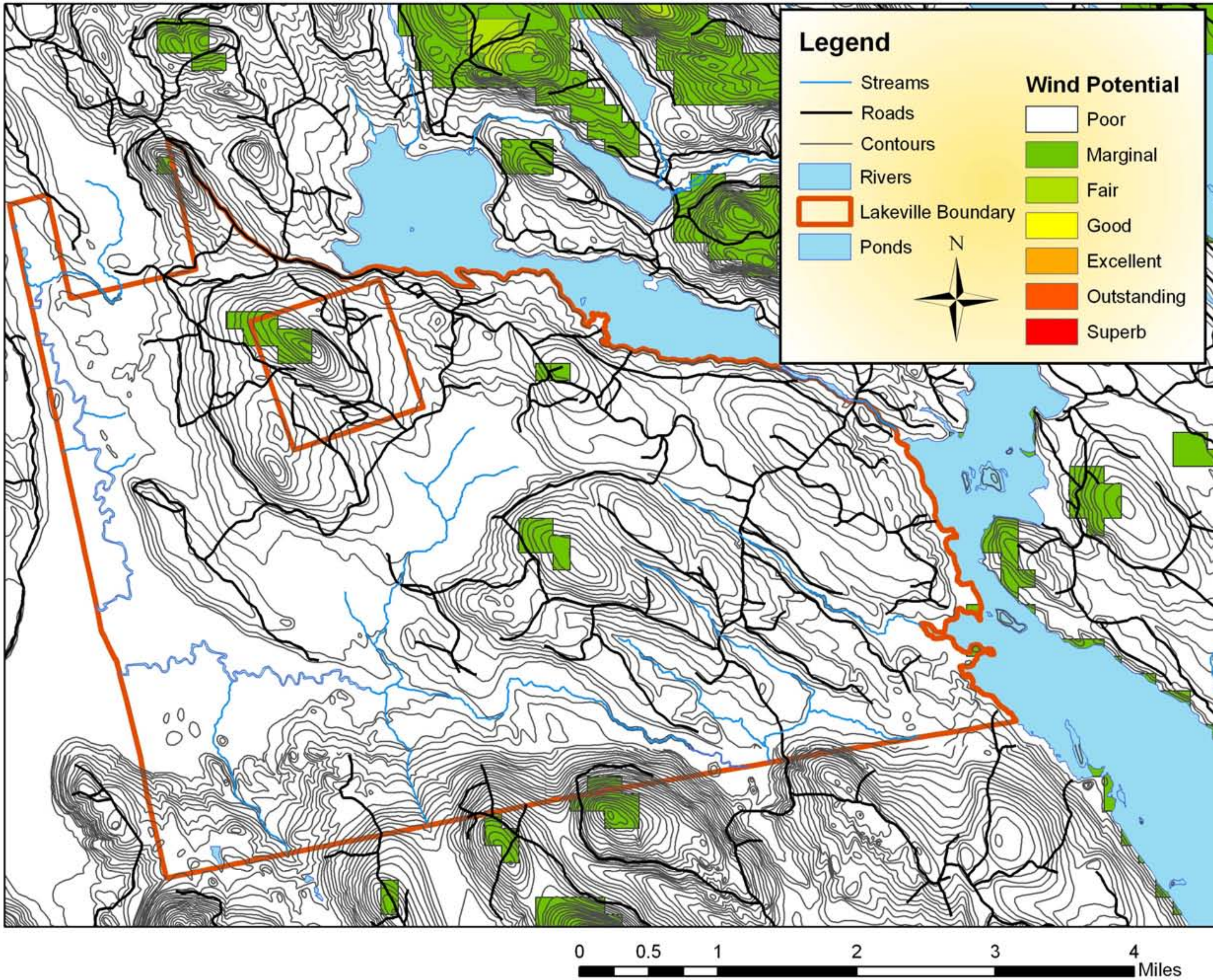
Carrabassett Valley Wind Potential



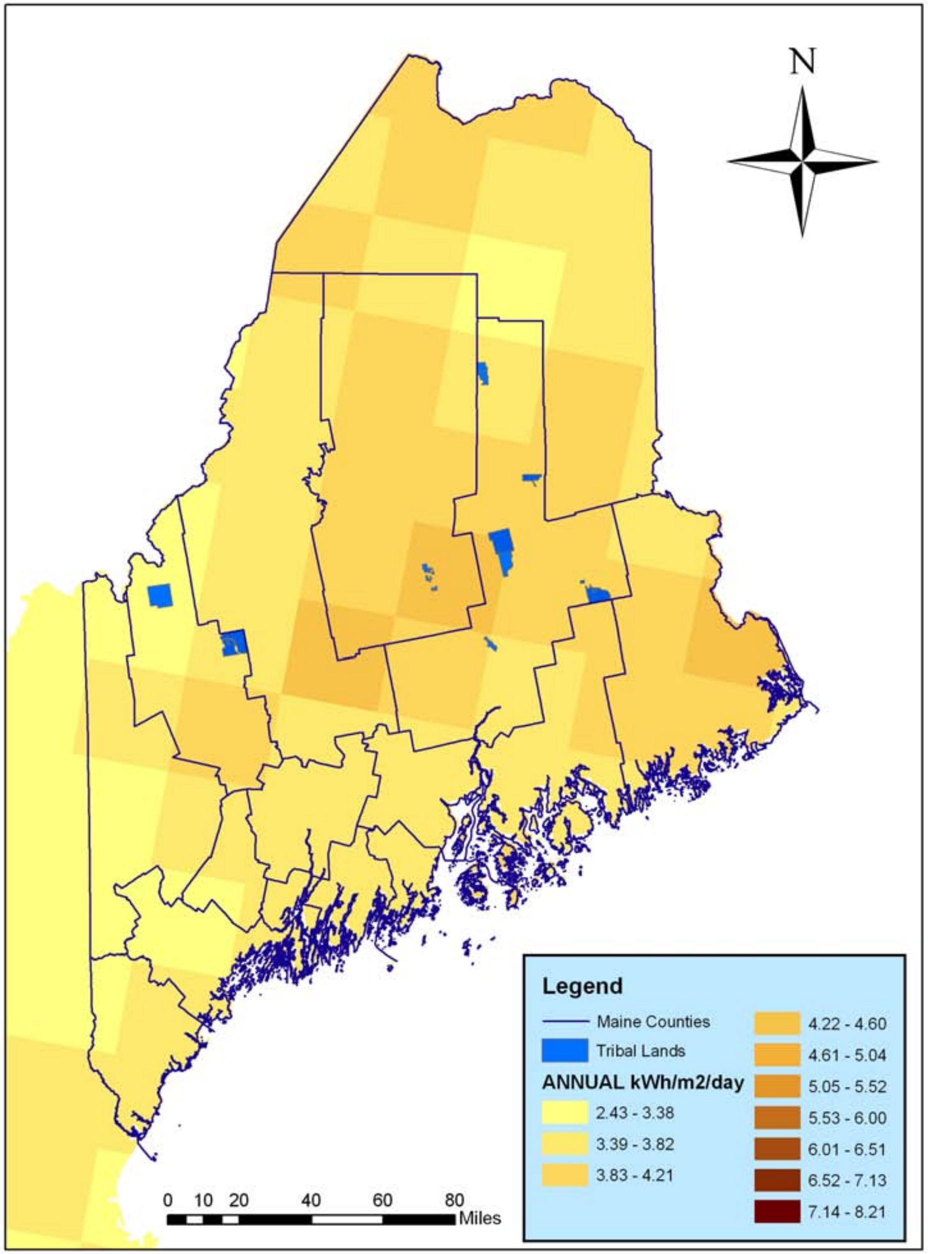
Sugarloaf Mtn. Area Wind Potential



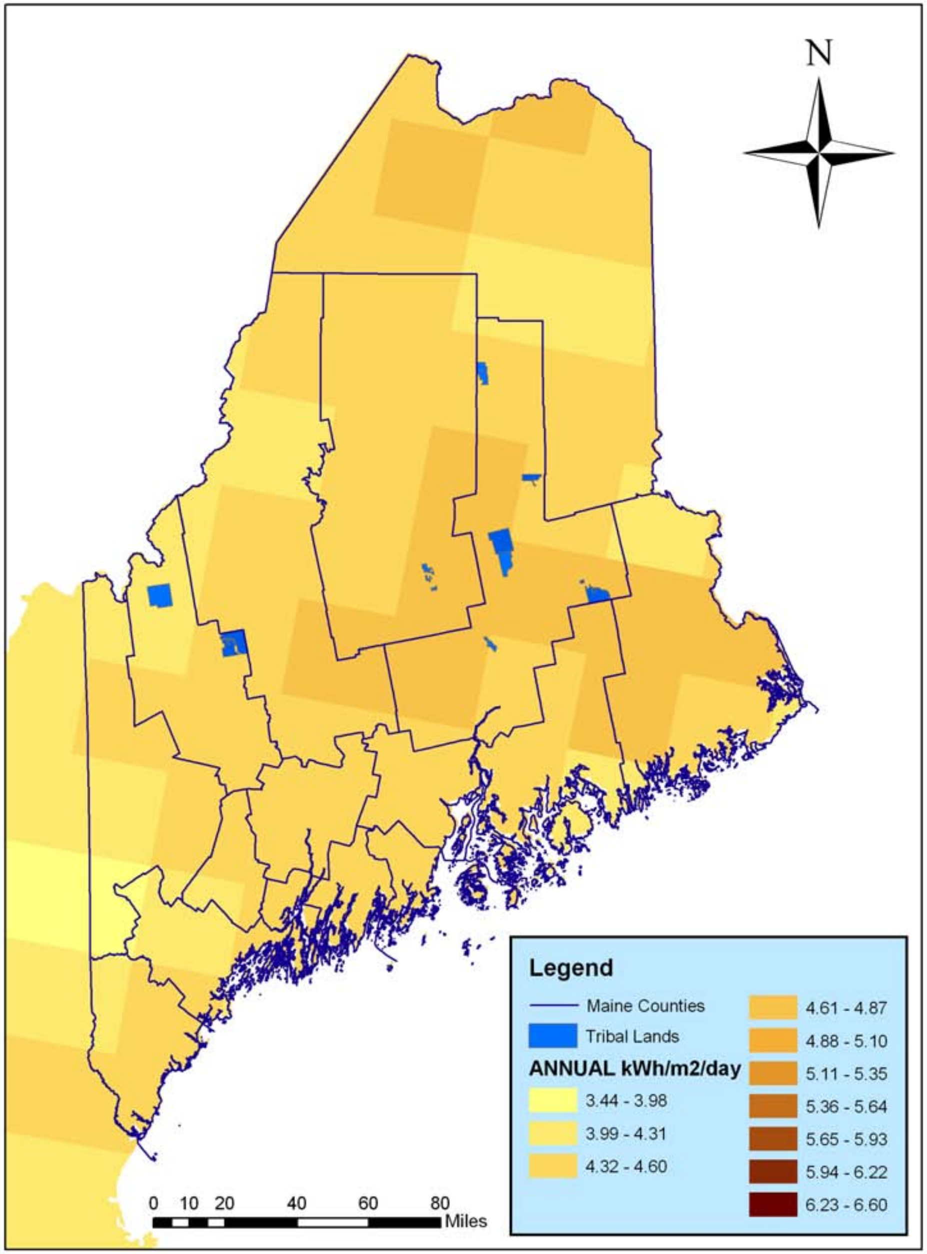
Lakeville Wind Potential



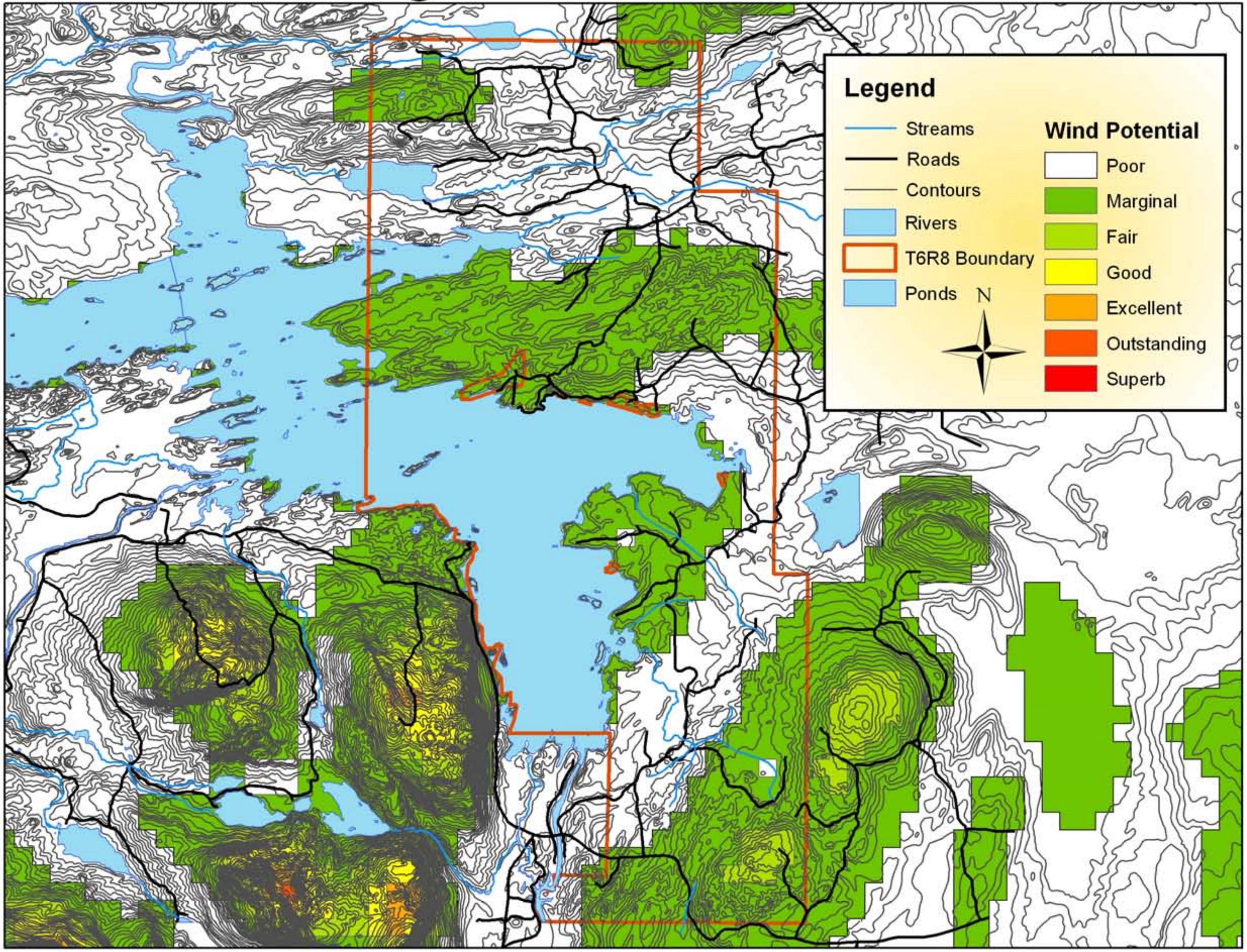
Maine Direct Normal Solar Radiation



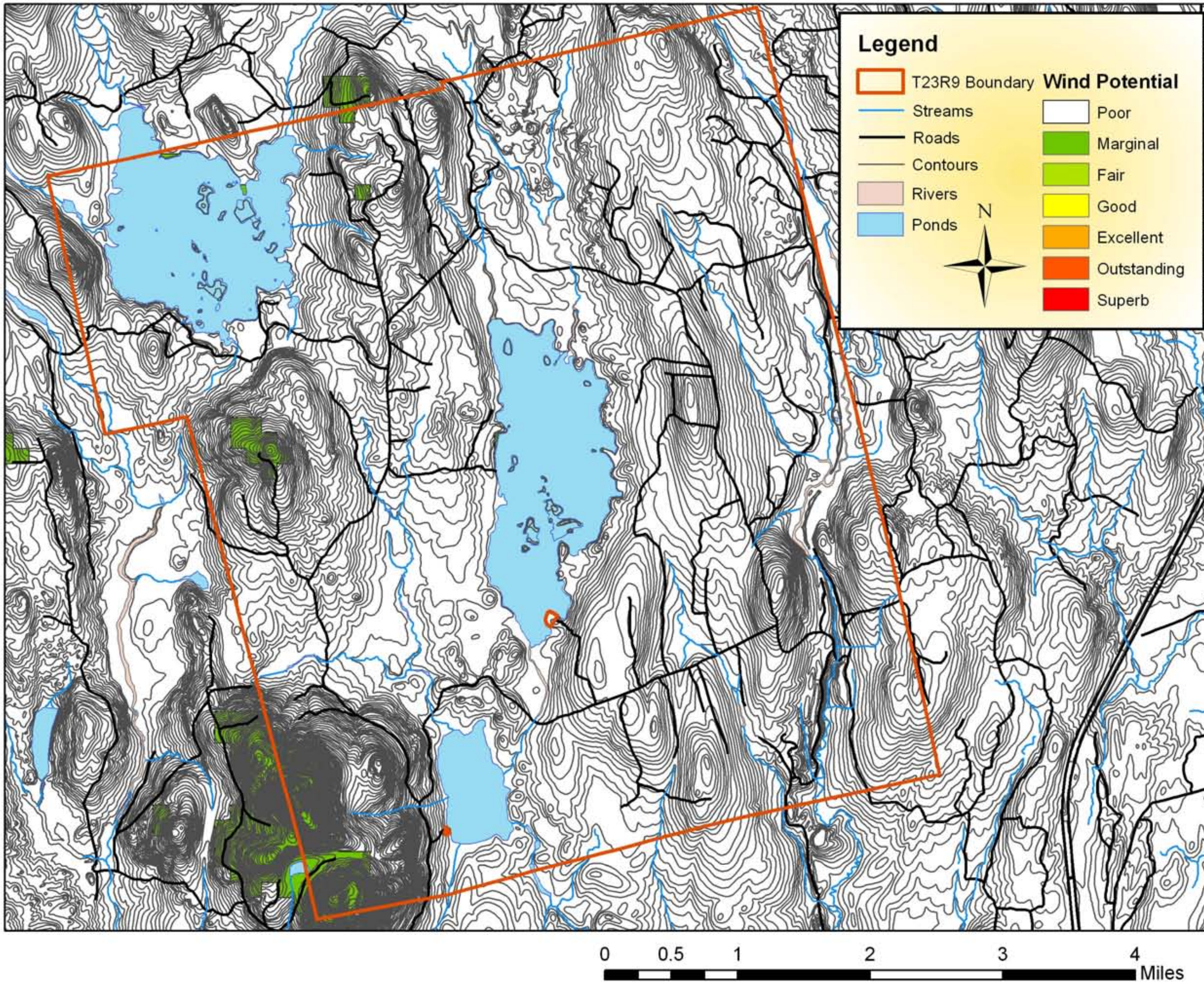
Maine PV Solar Radiation



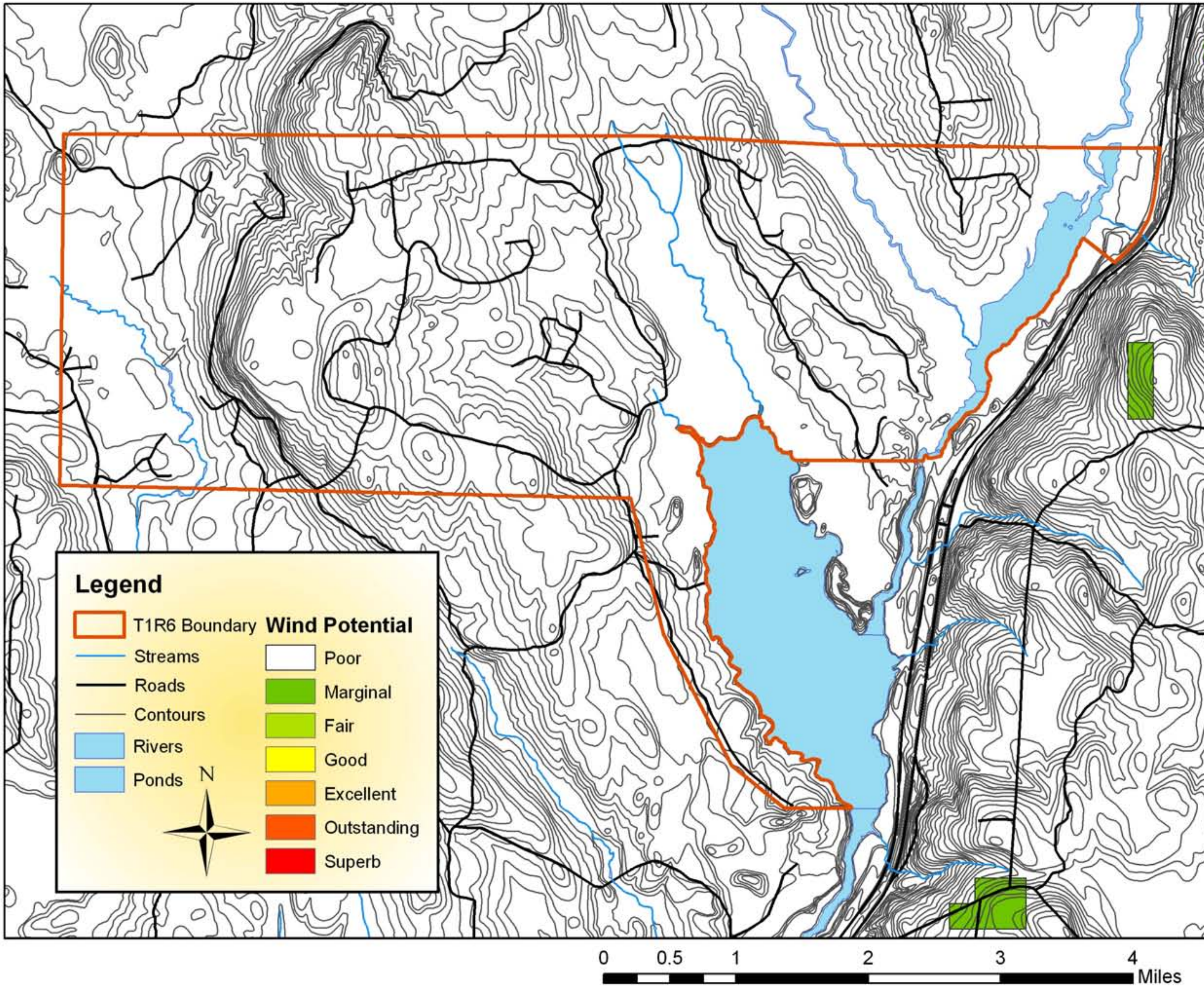
Matagamon Wind Potential



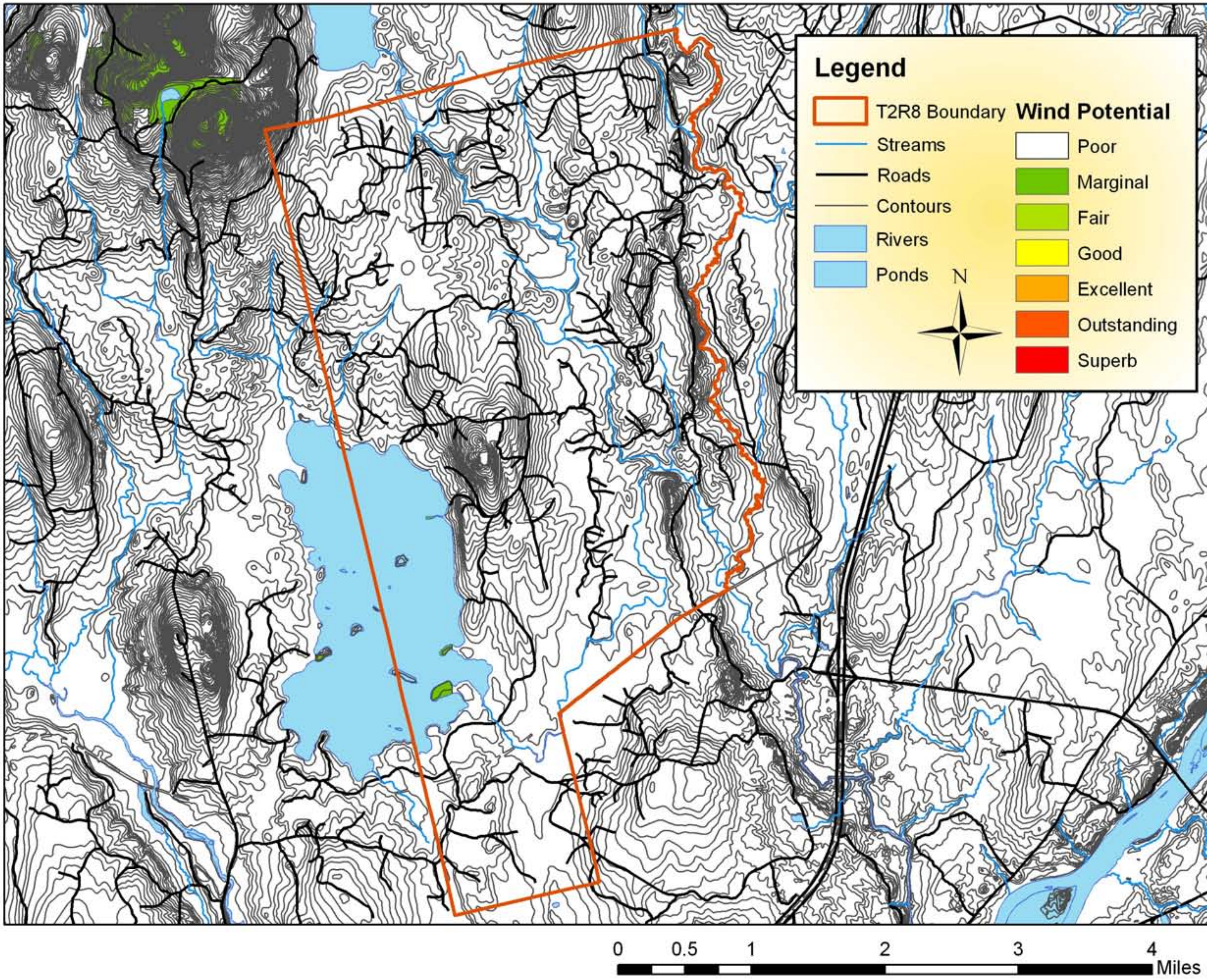
Mattamiscontis Wind Potential



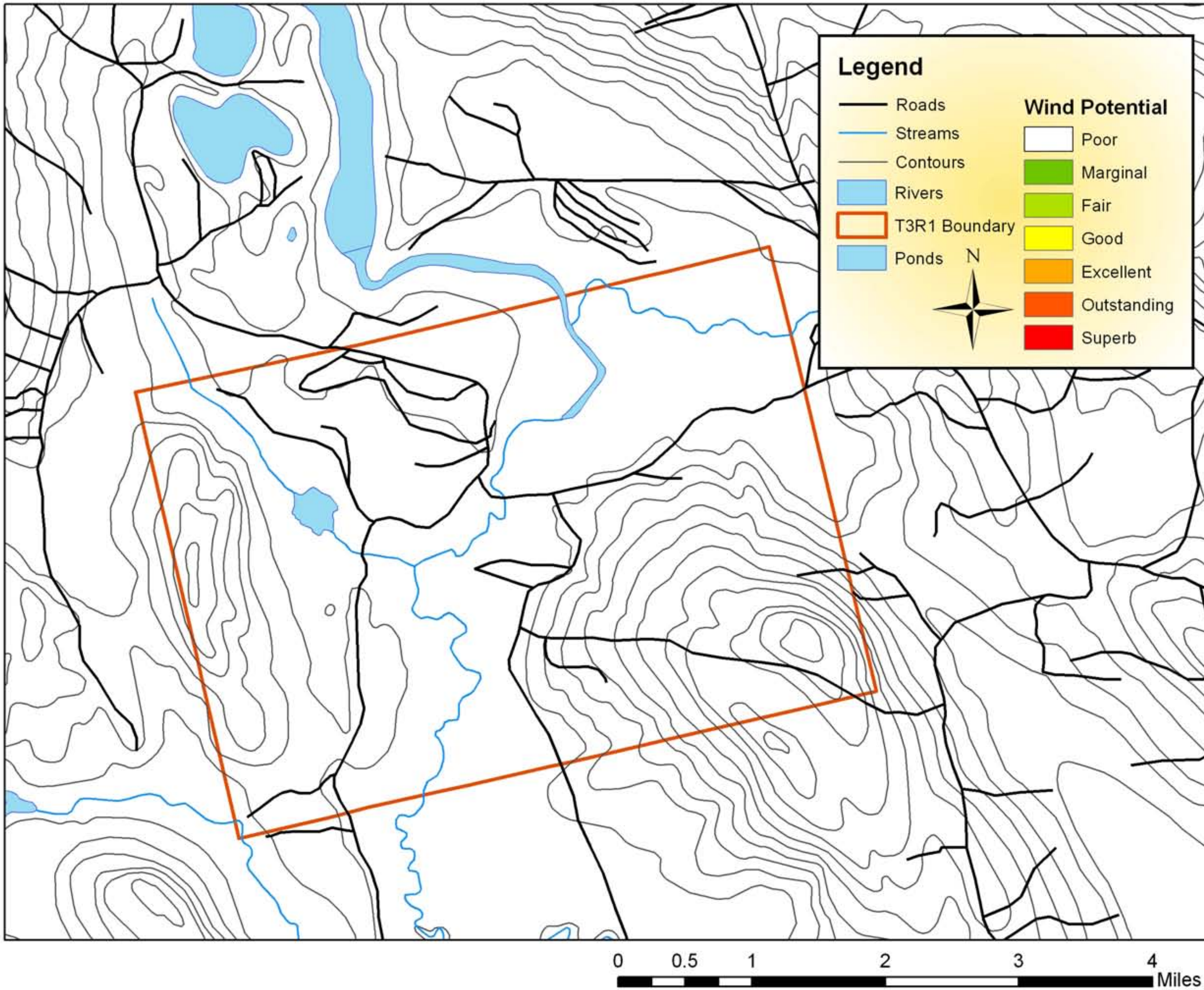
T1R6 Wind Potential



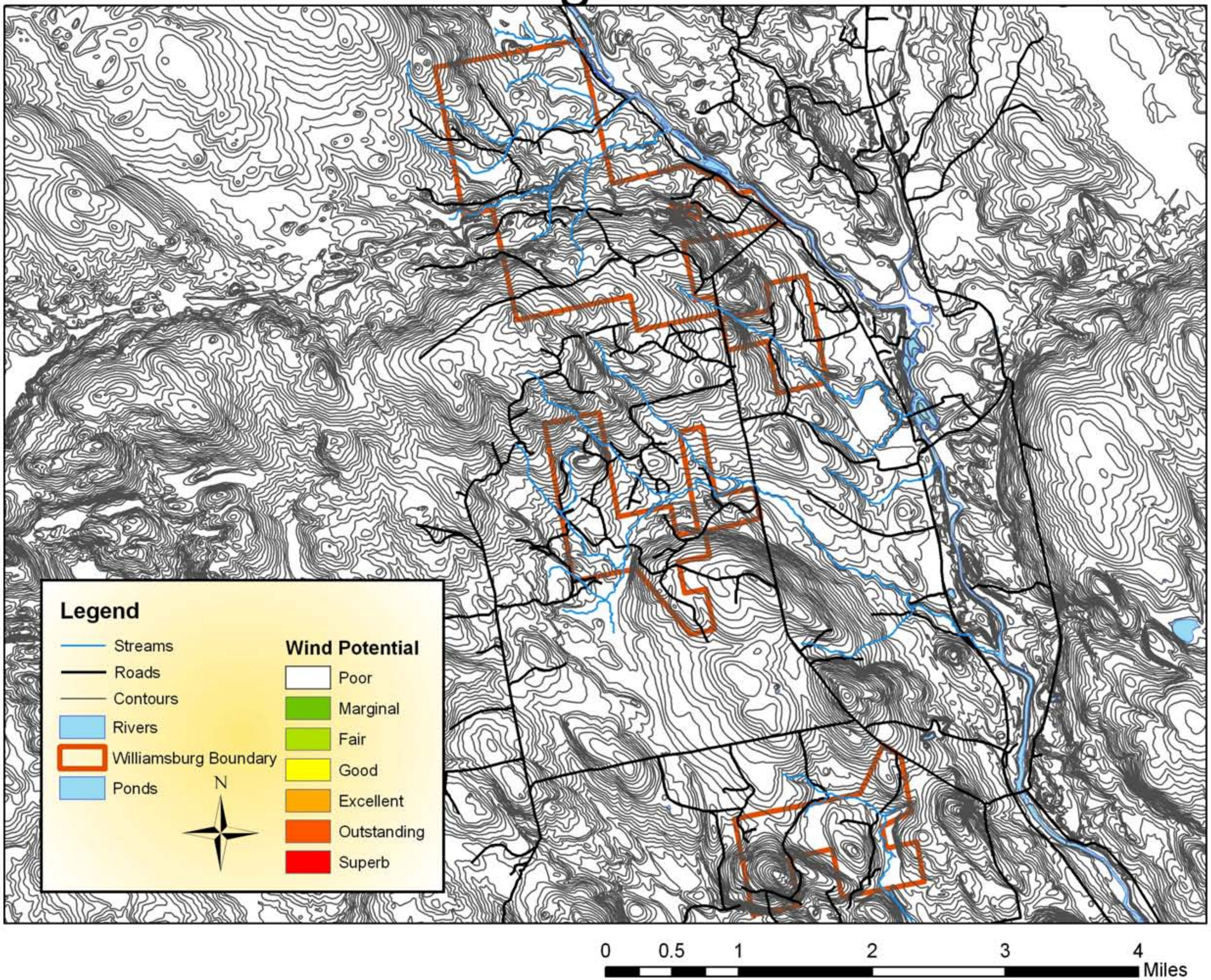
T2R8 Wind Potential



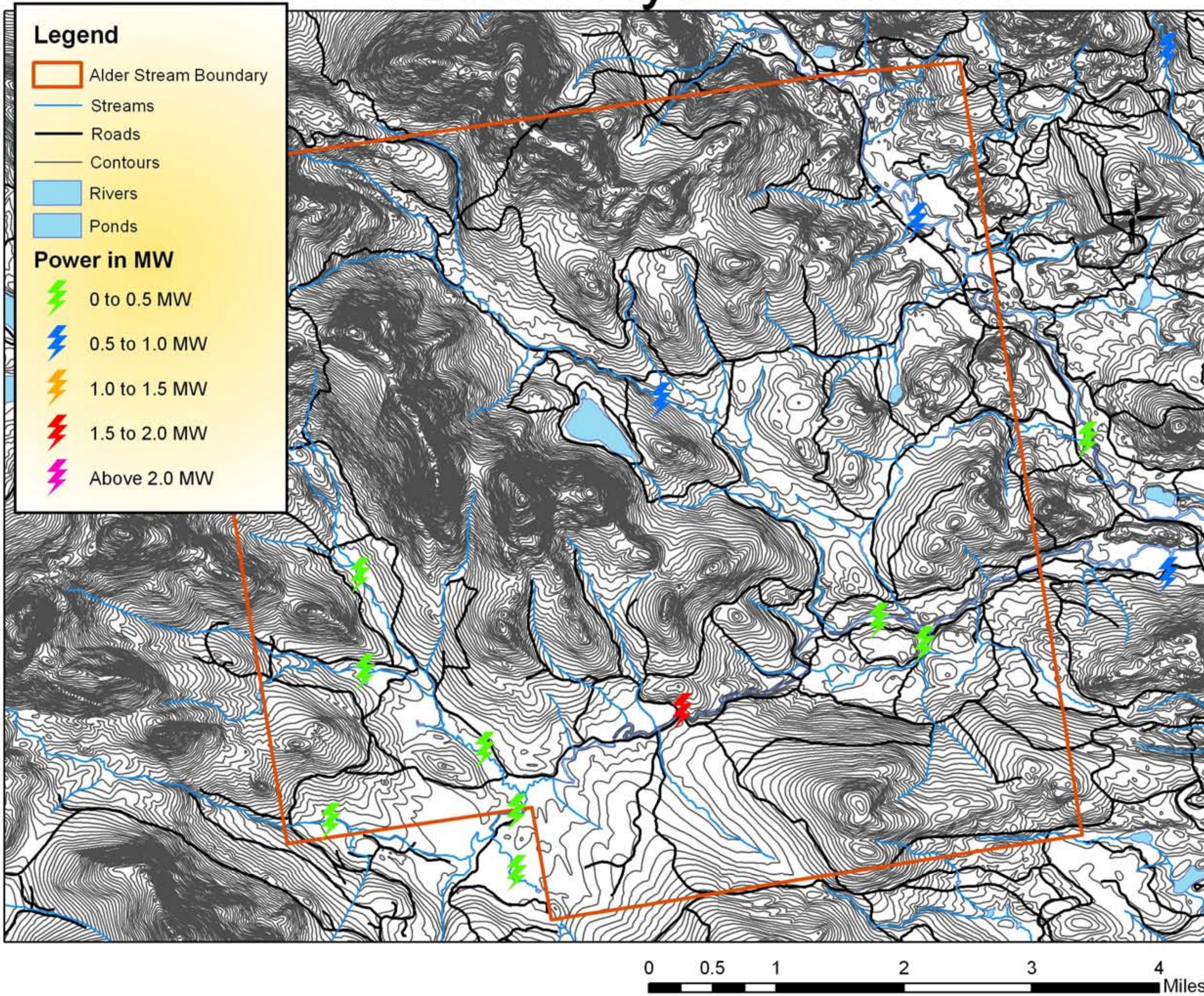
T3R1 Wind Potential



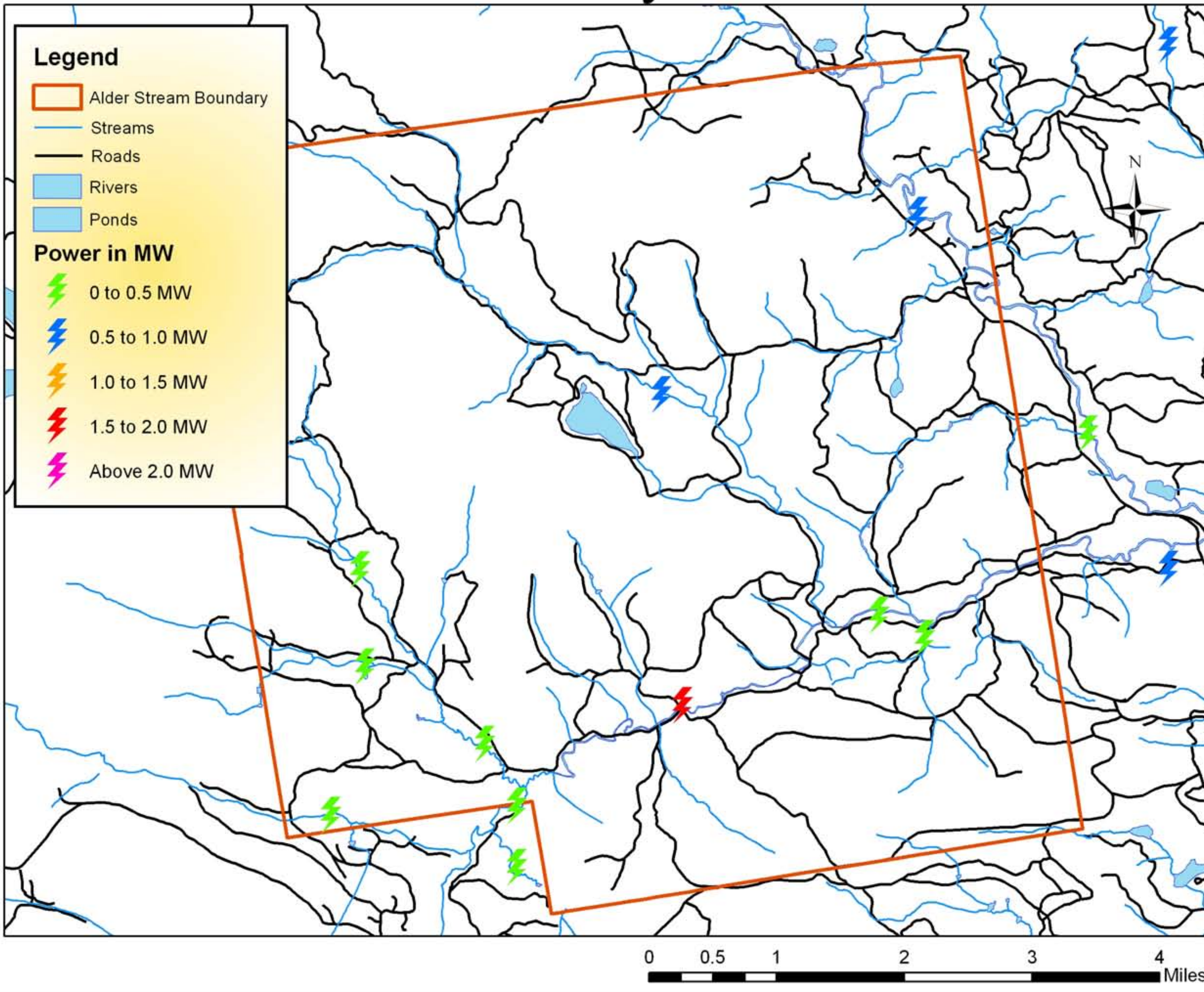
Williamsburg Wind Potential



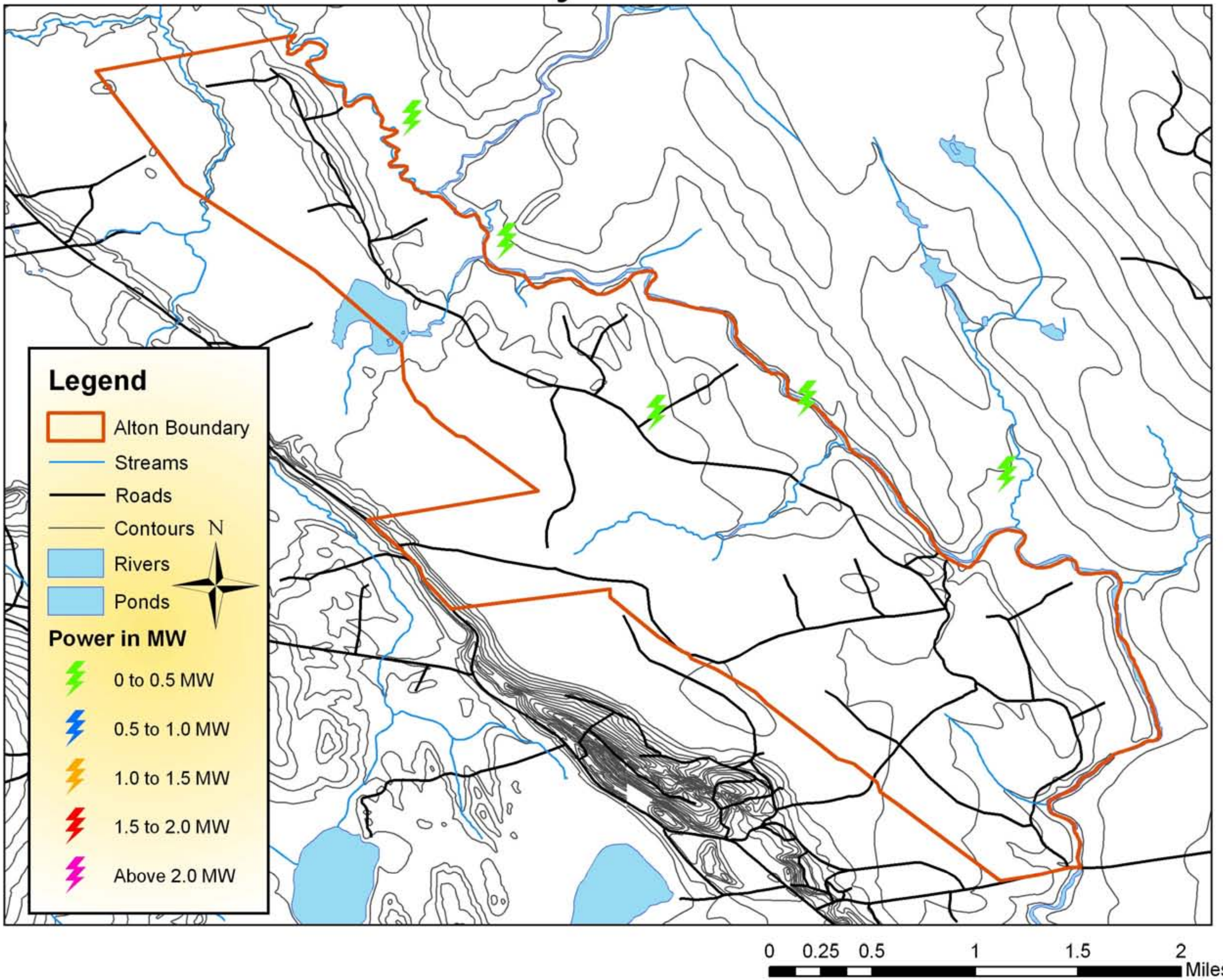
Alder Stream Hydro Potential



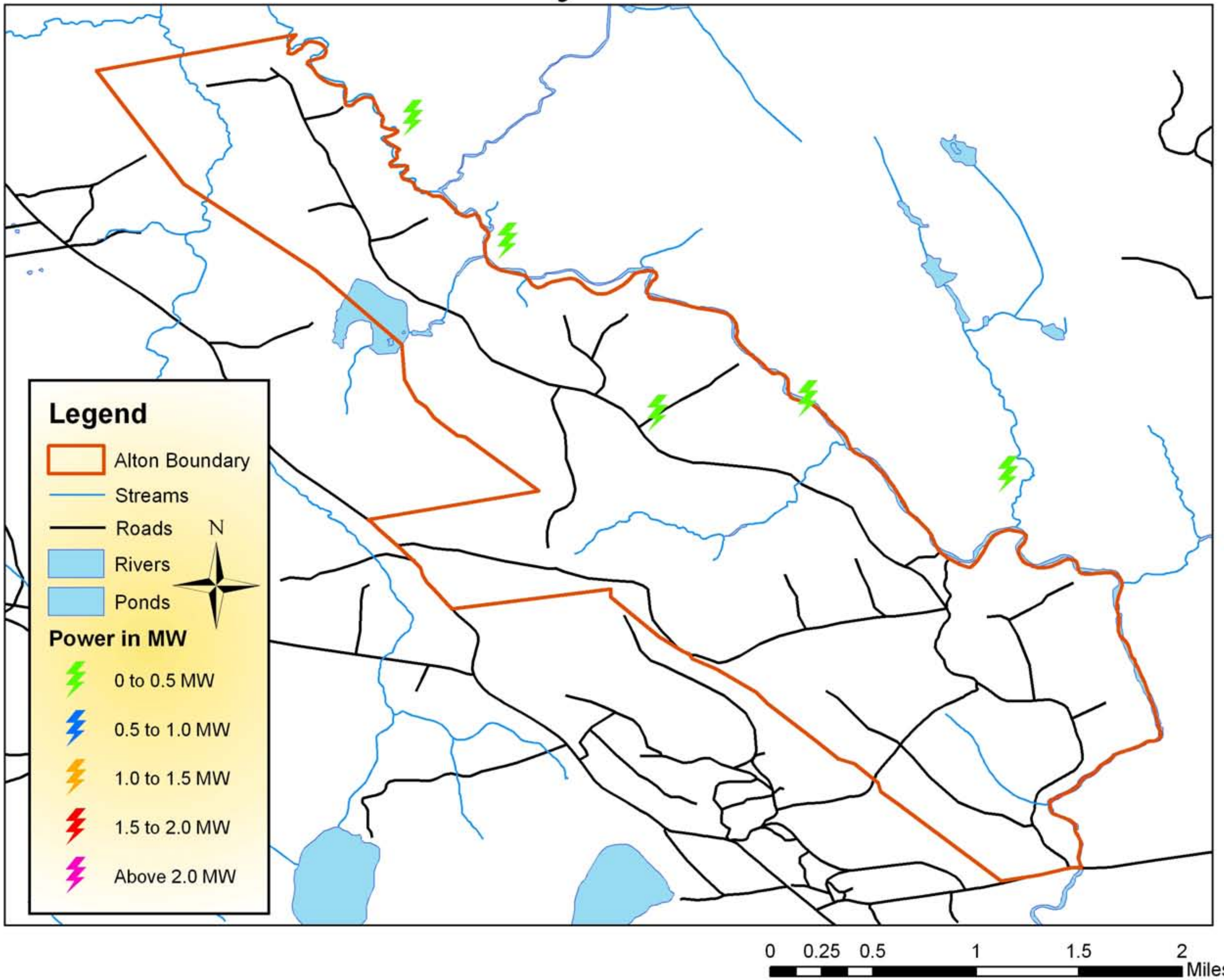
Alder Stream Hydro Potential



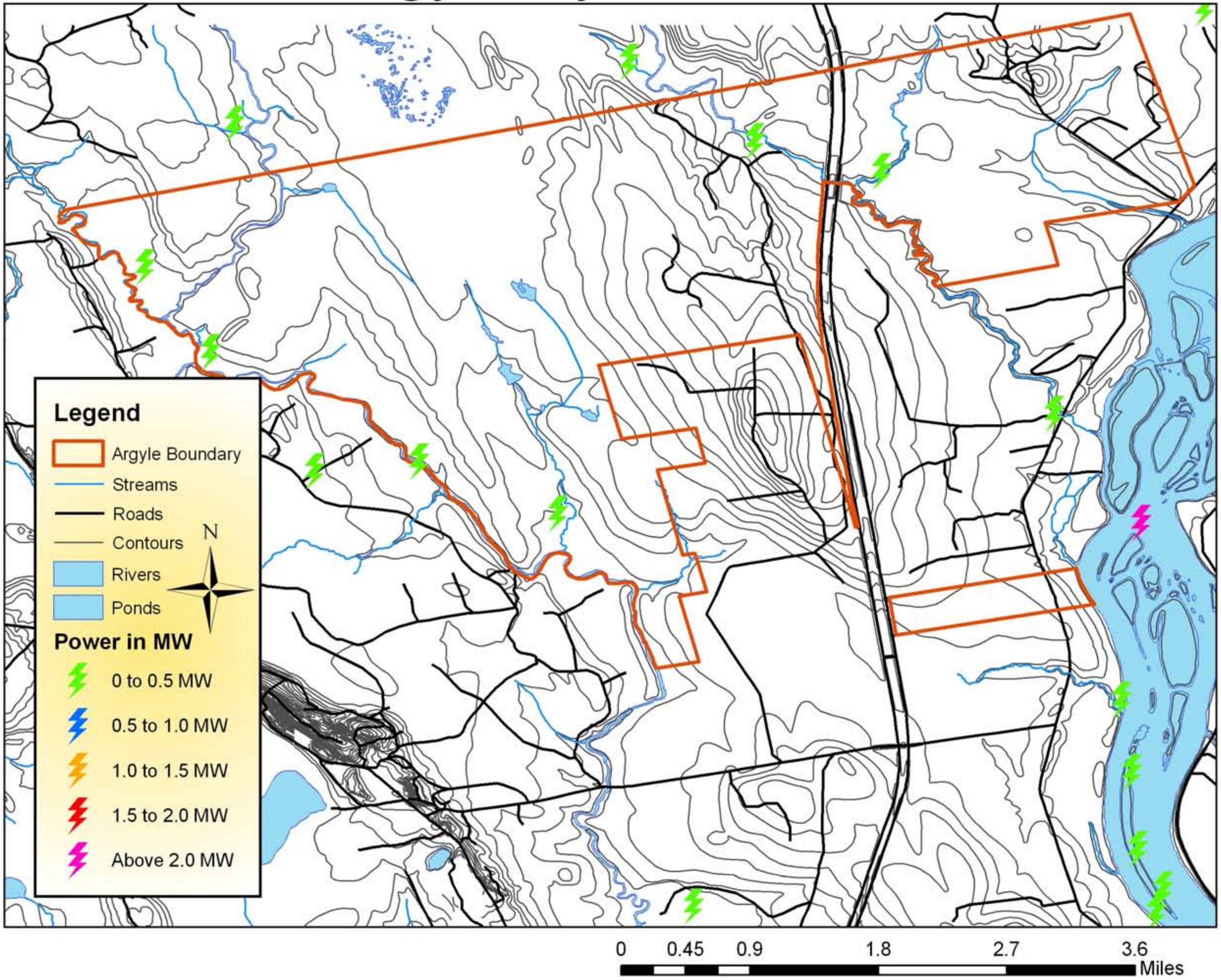
Alton Hydro Potential



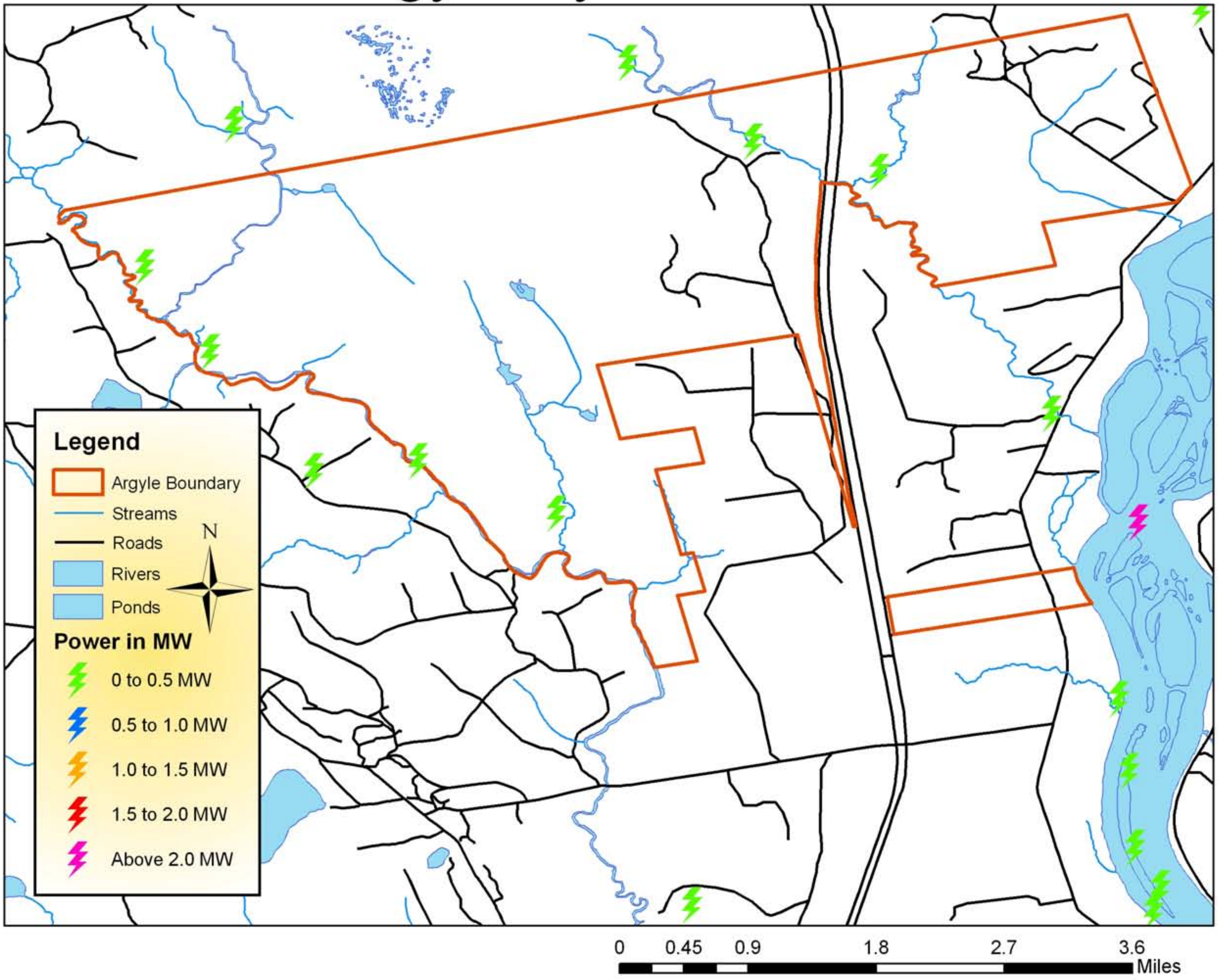
Alton Hydro Potential



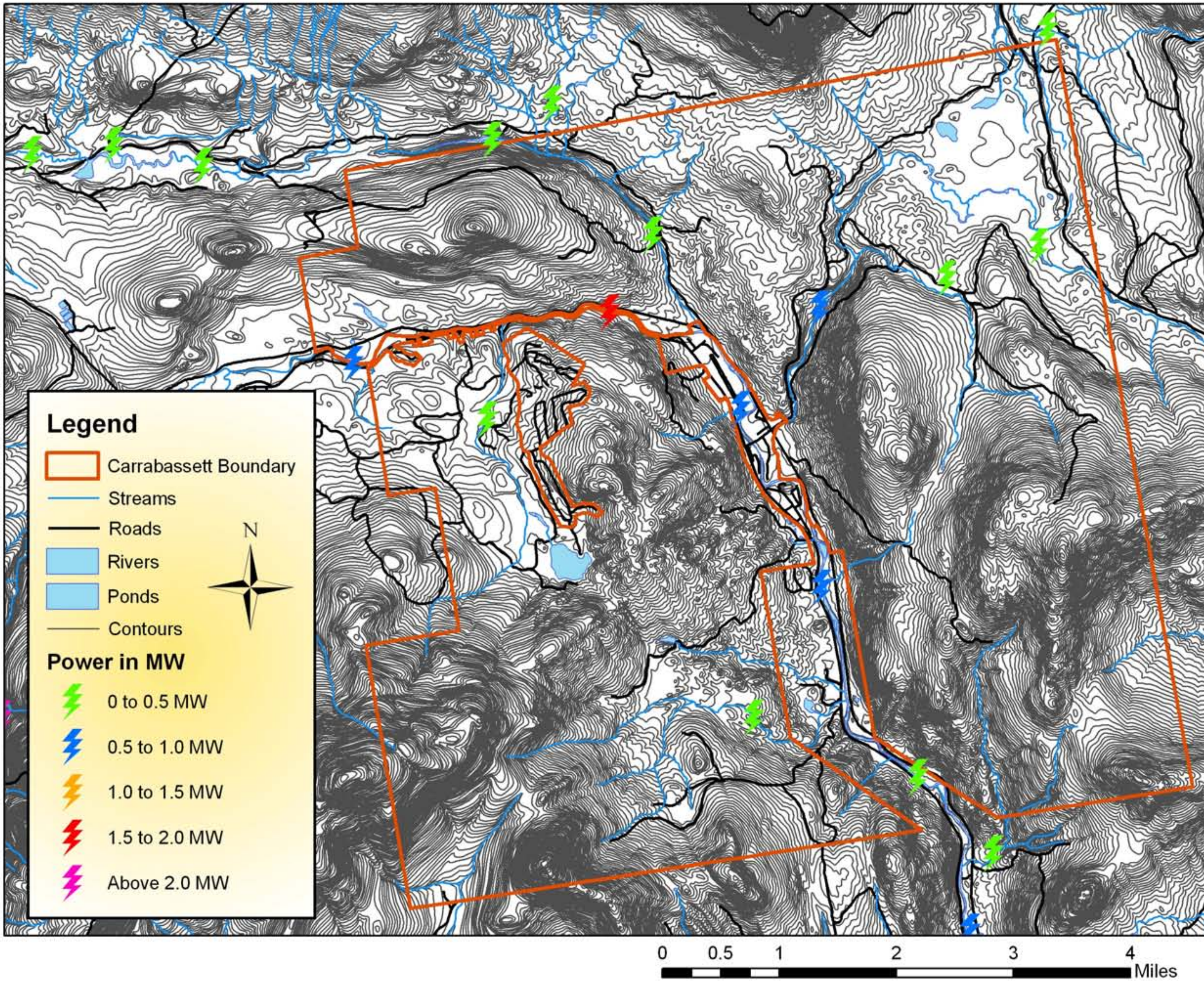
Argyle Hydro Potential



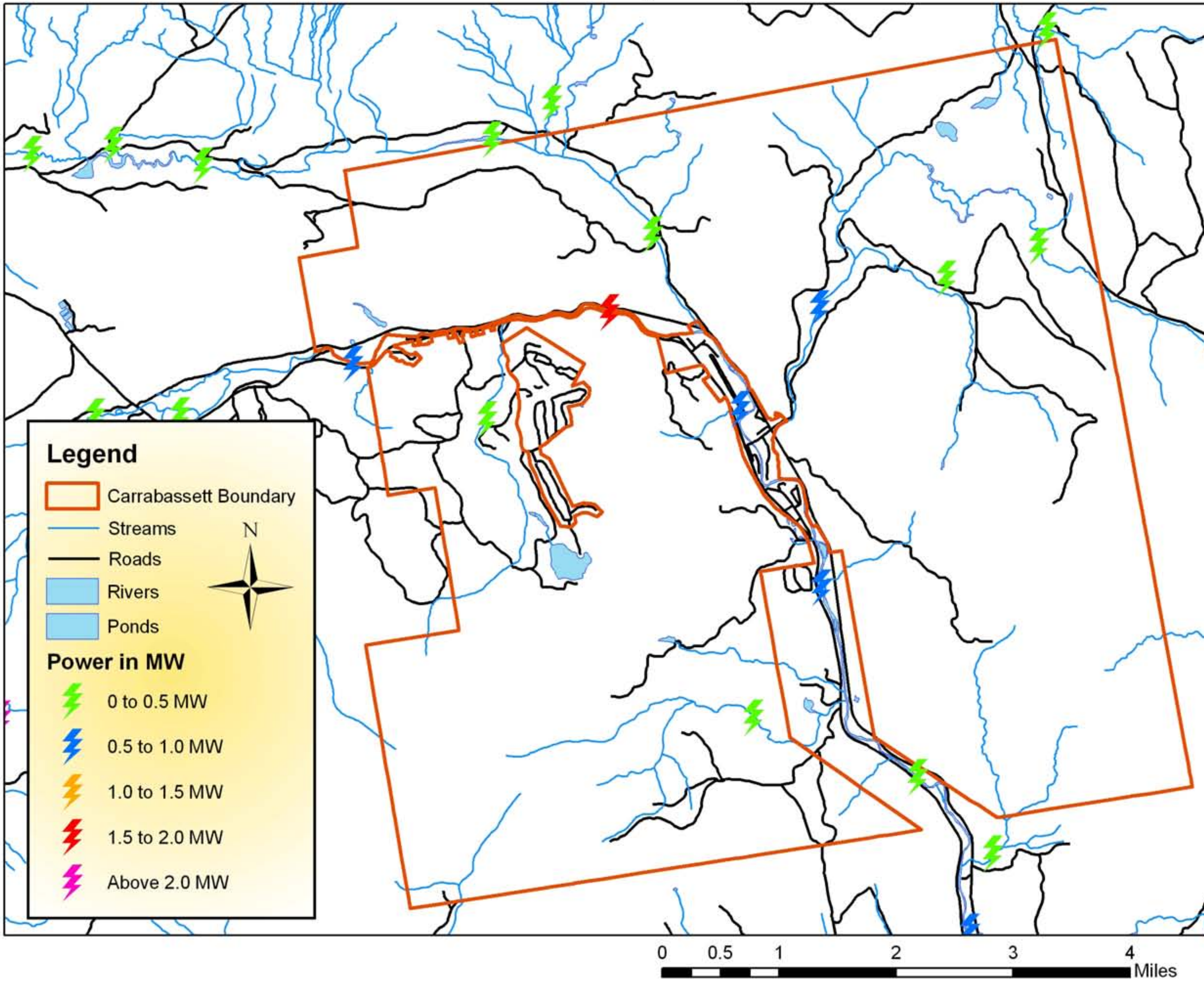
Argyle Hydro Potential



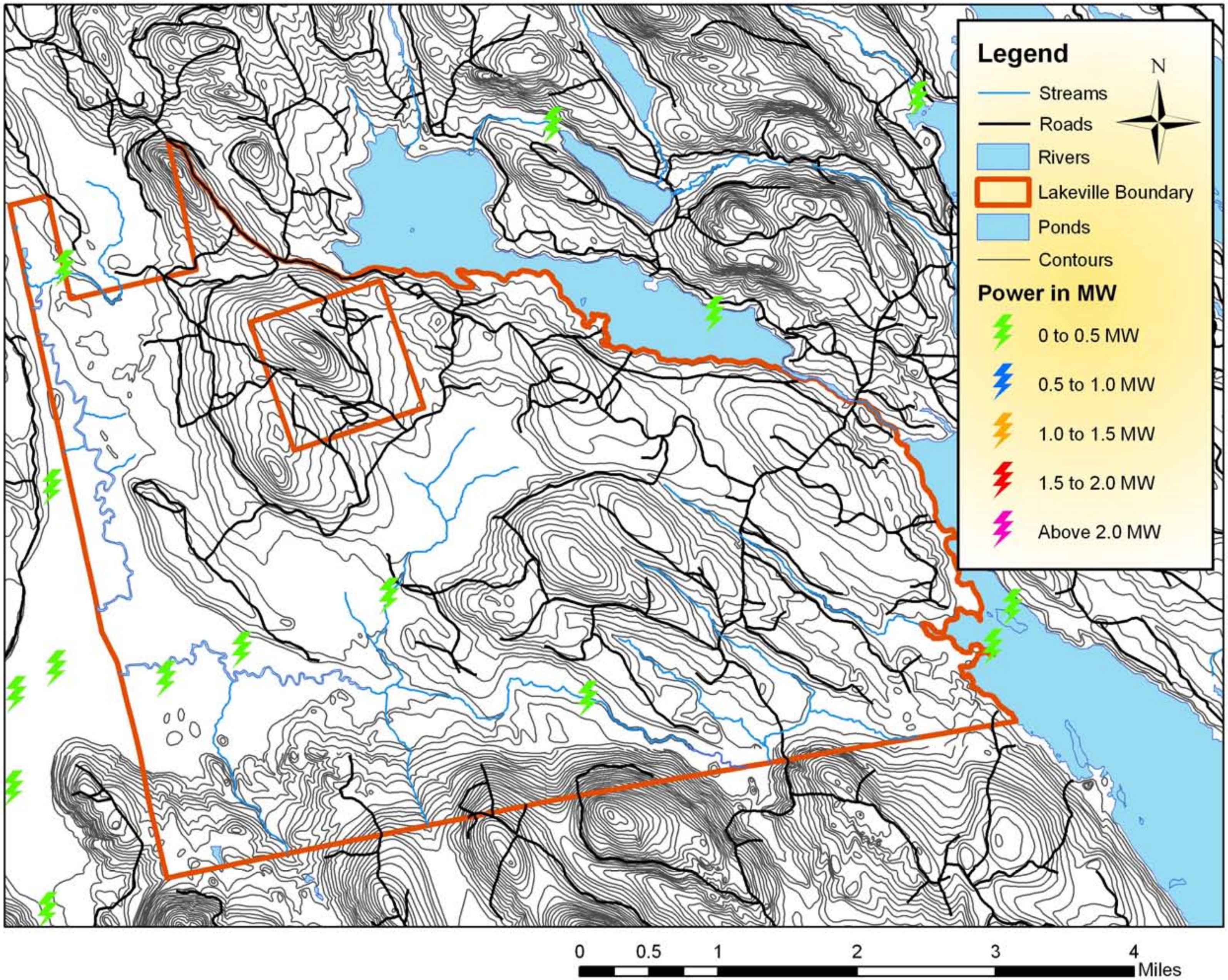
Carrabassett Valley Hydro Potential



Carrabassett Valley Hydro Potential



Lakeville Hydro Potential



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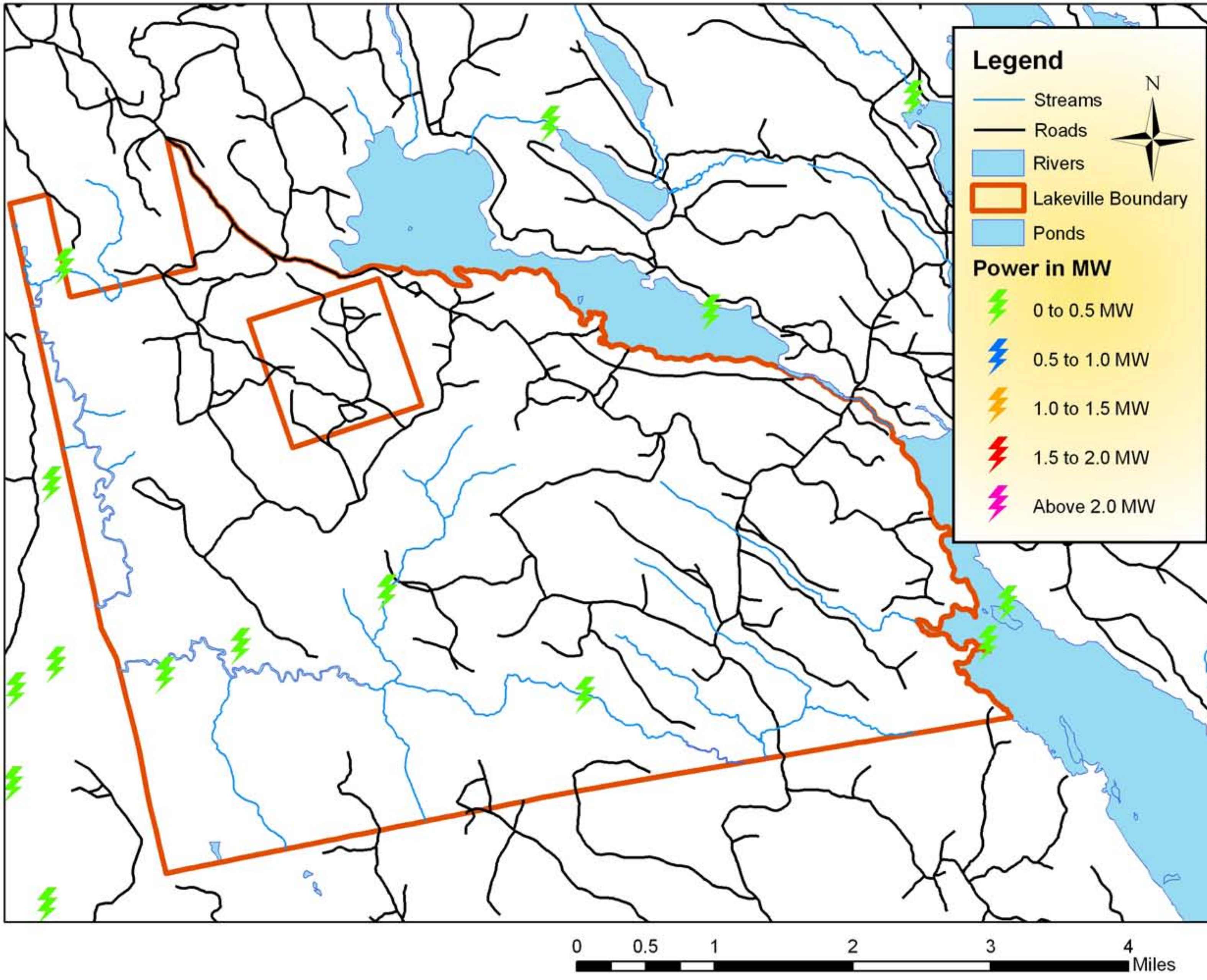
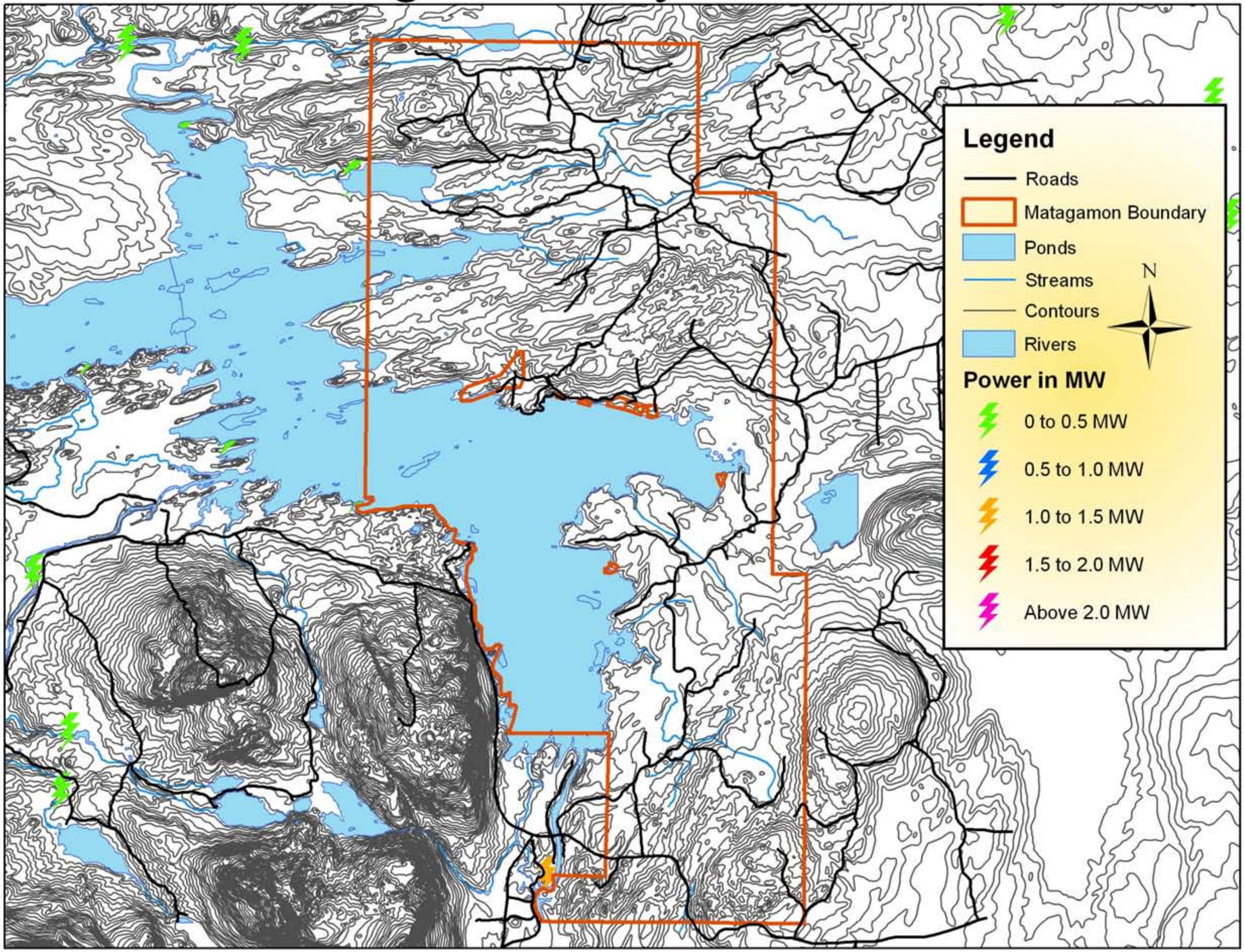
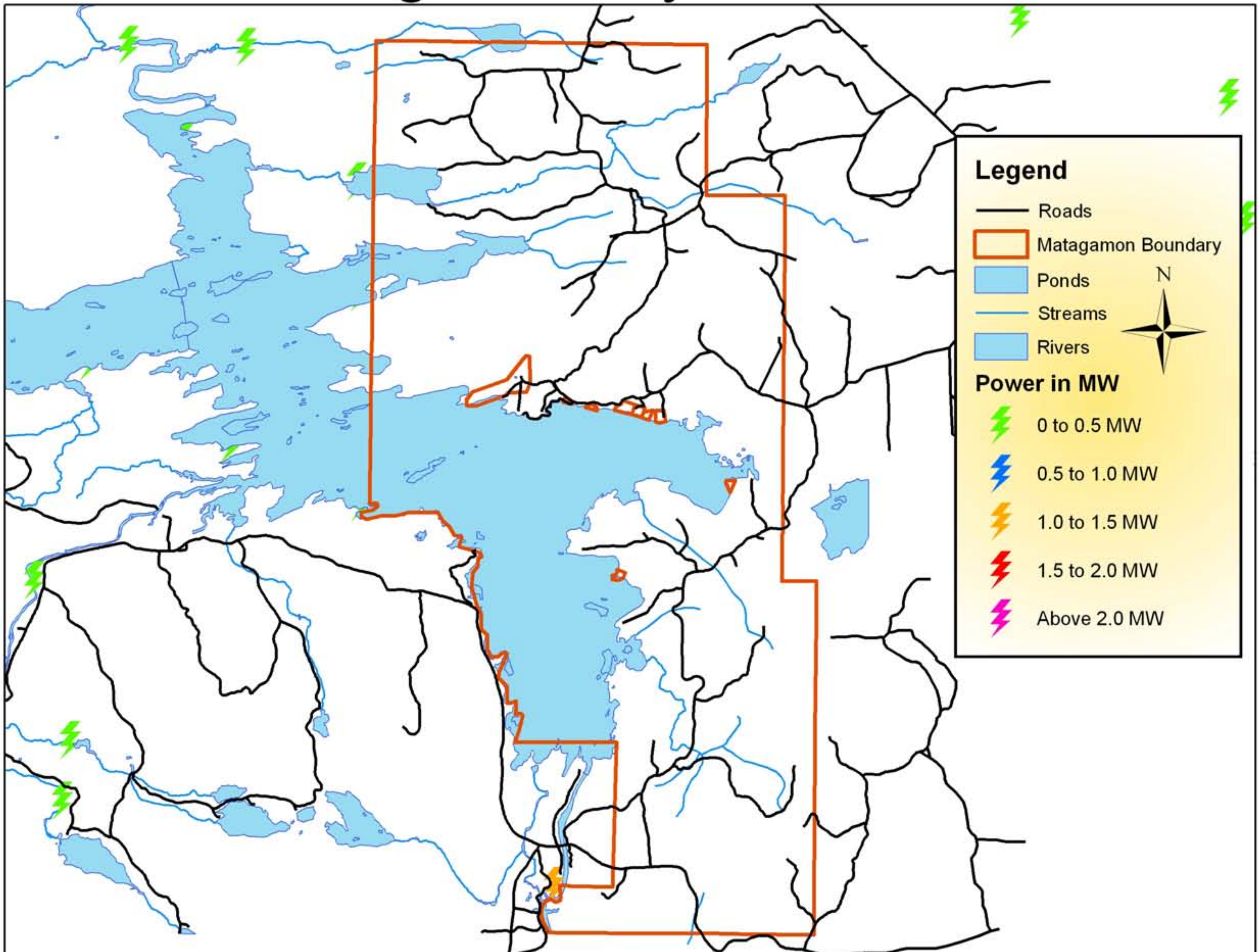


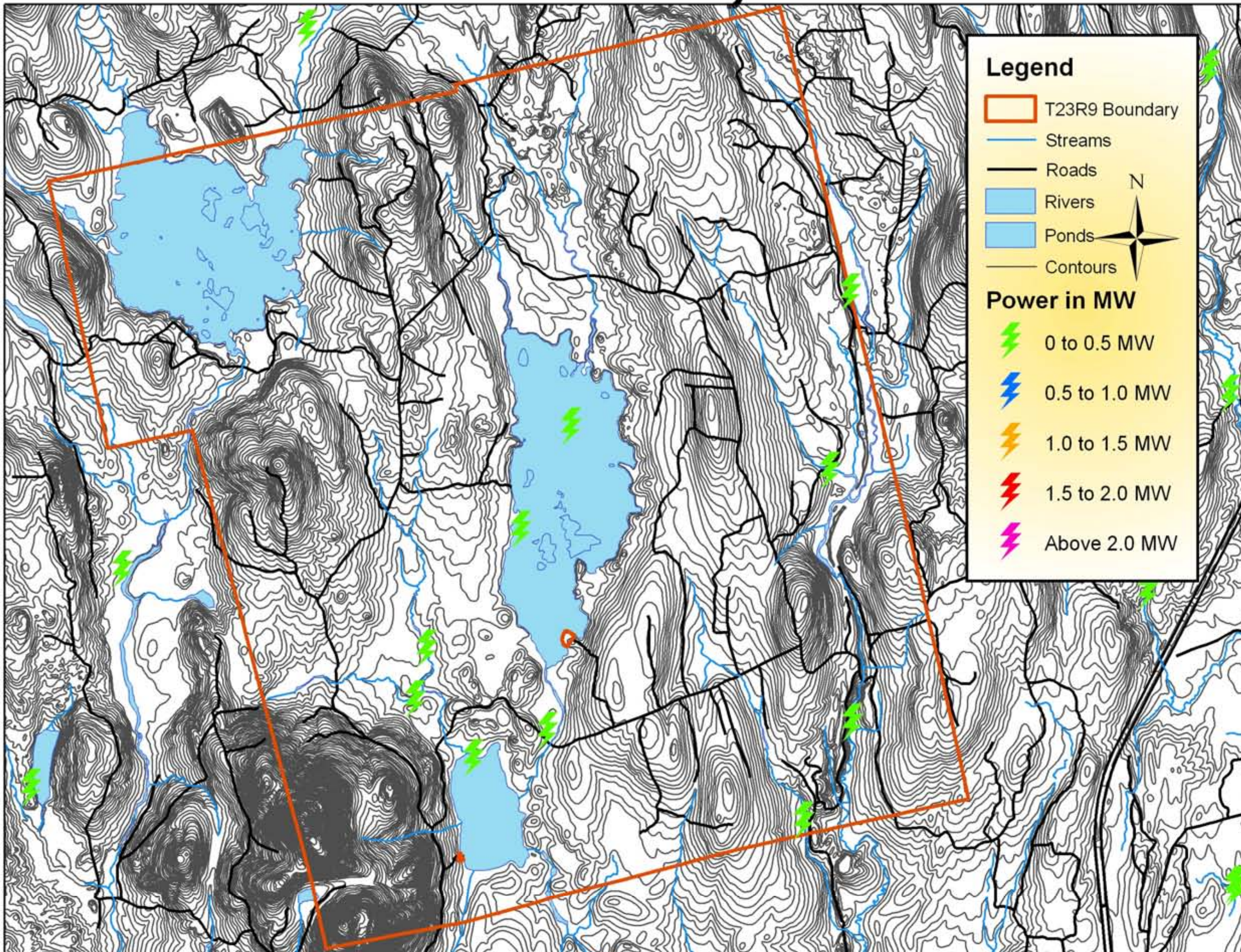
Matagamon Hydro Potential



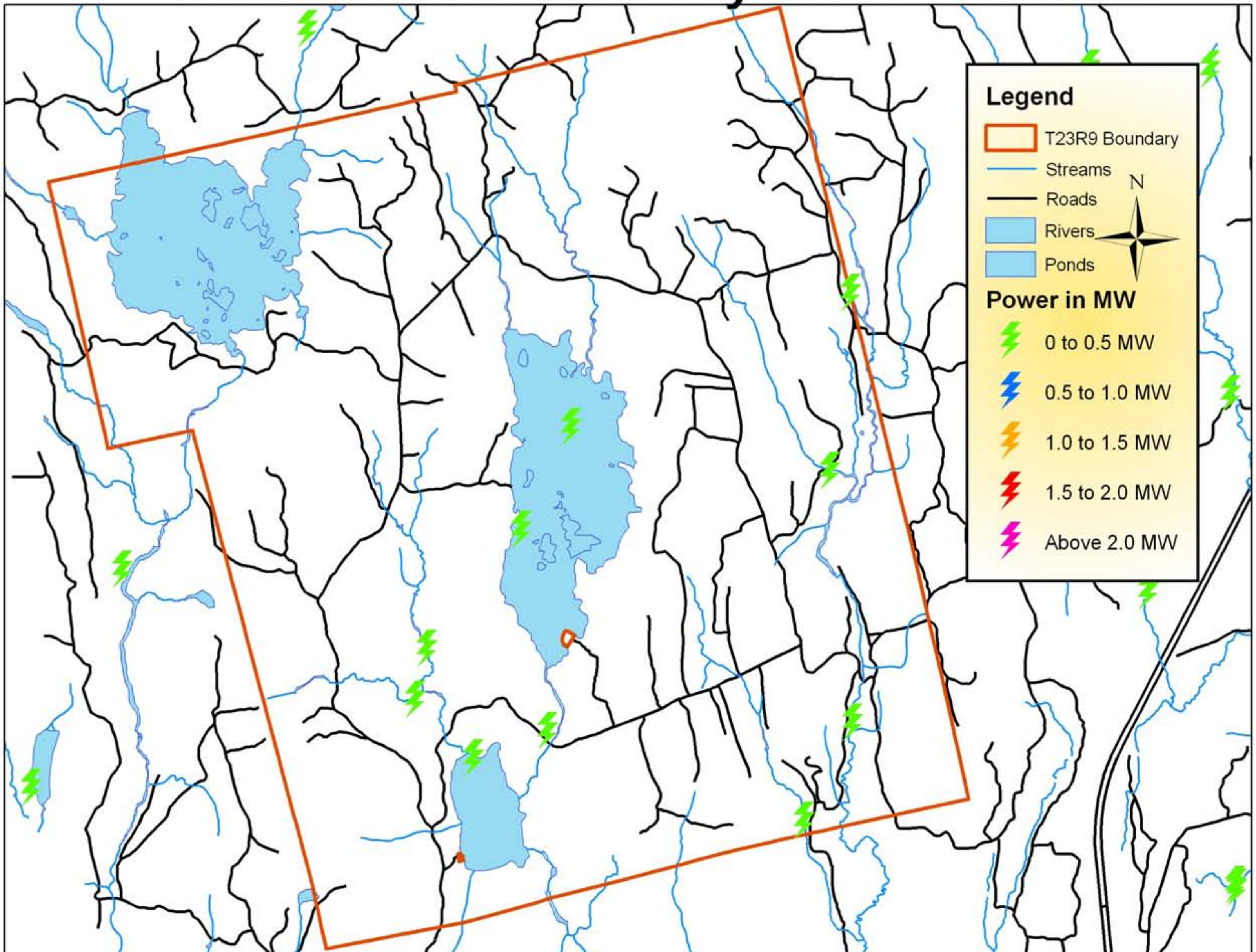
Matagamon Hydro Potential



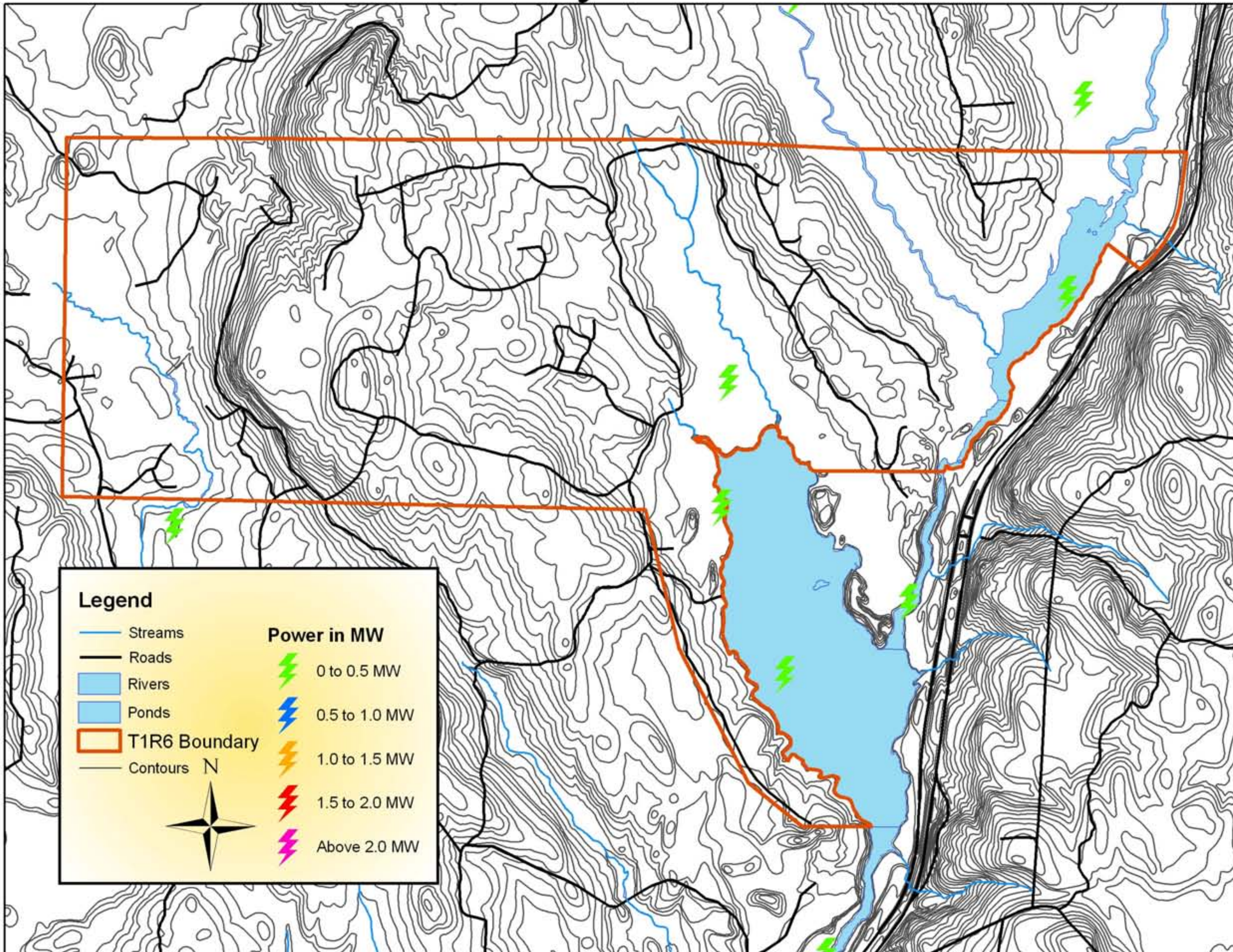
Mattamiscontis Hydro Potential



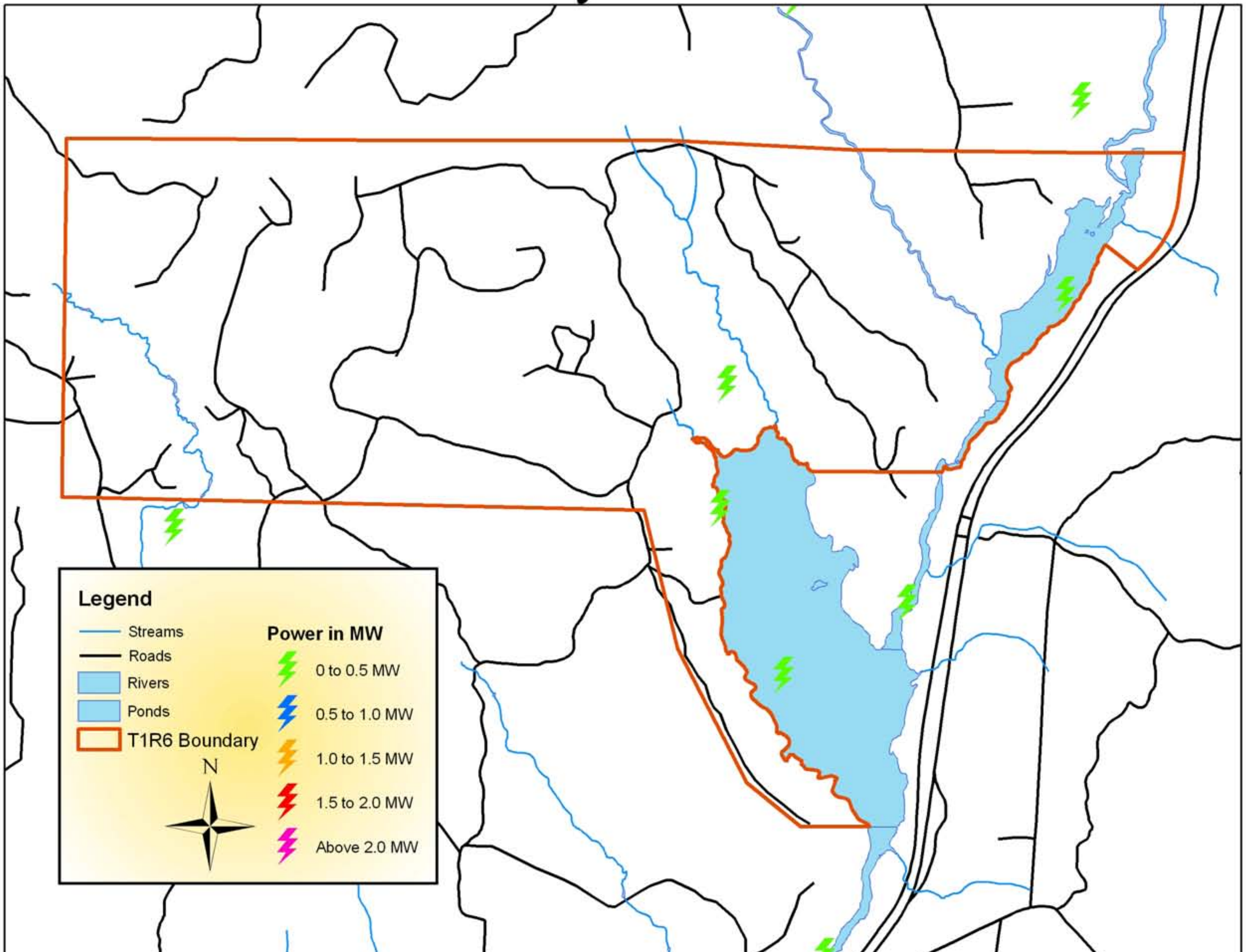
Mattamiscontis Hydro Potential



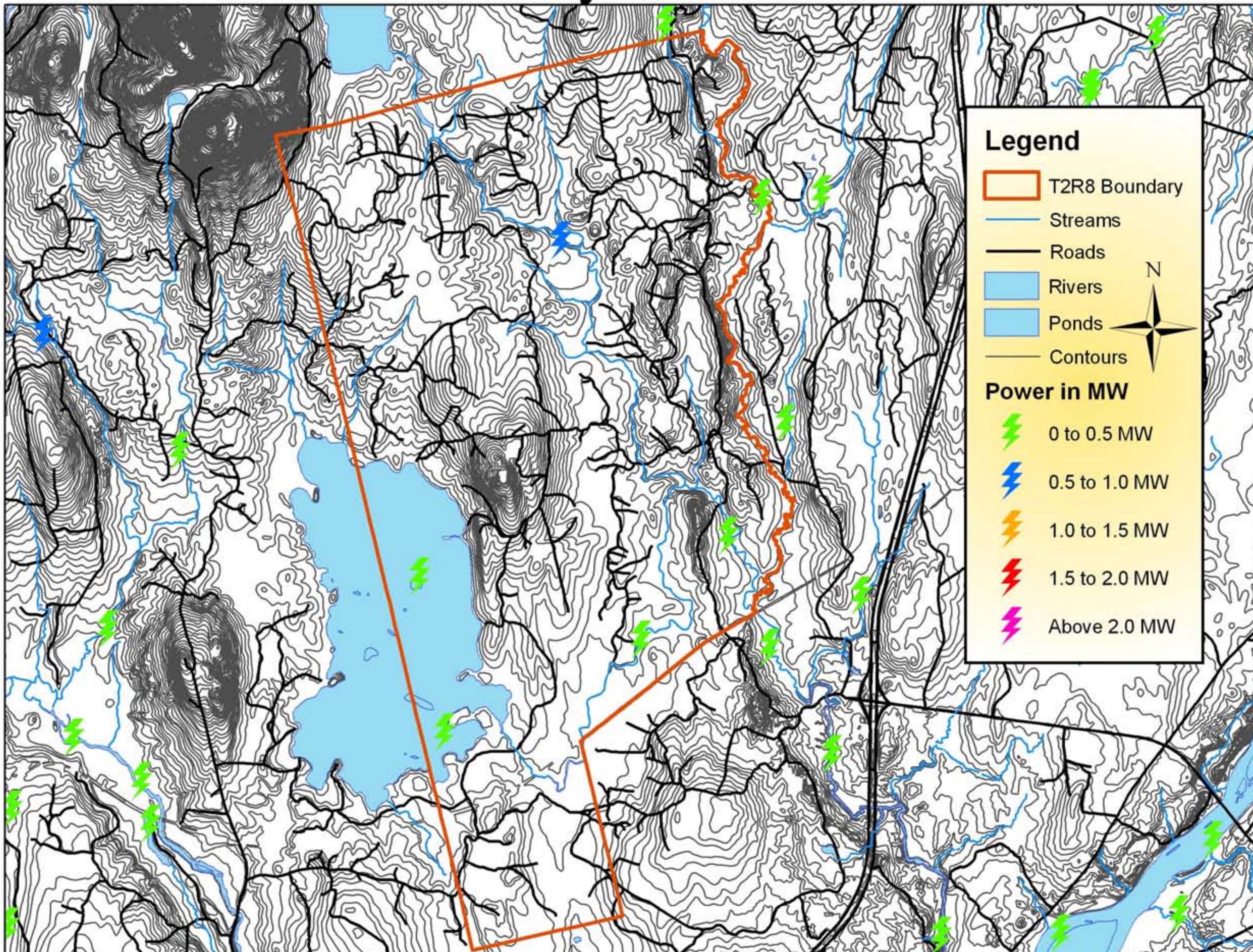
T1R6 Hydro Potential



T1R6 Hydro Potential



T2R8 Hydro Potential



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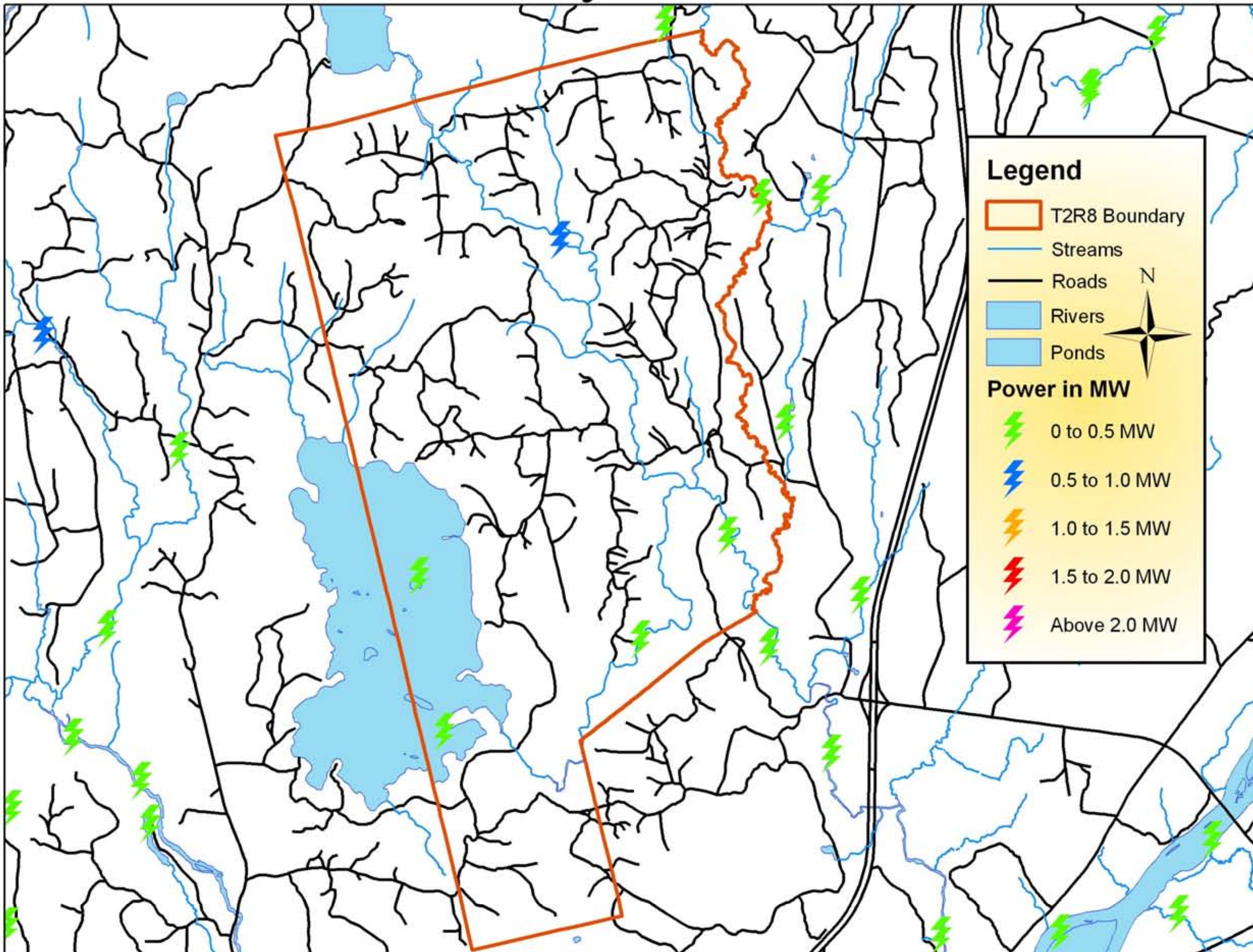
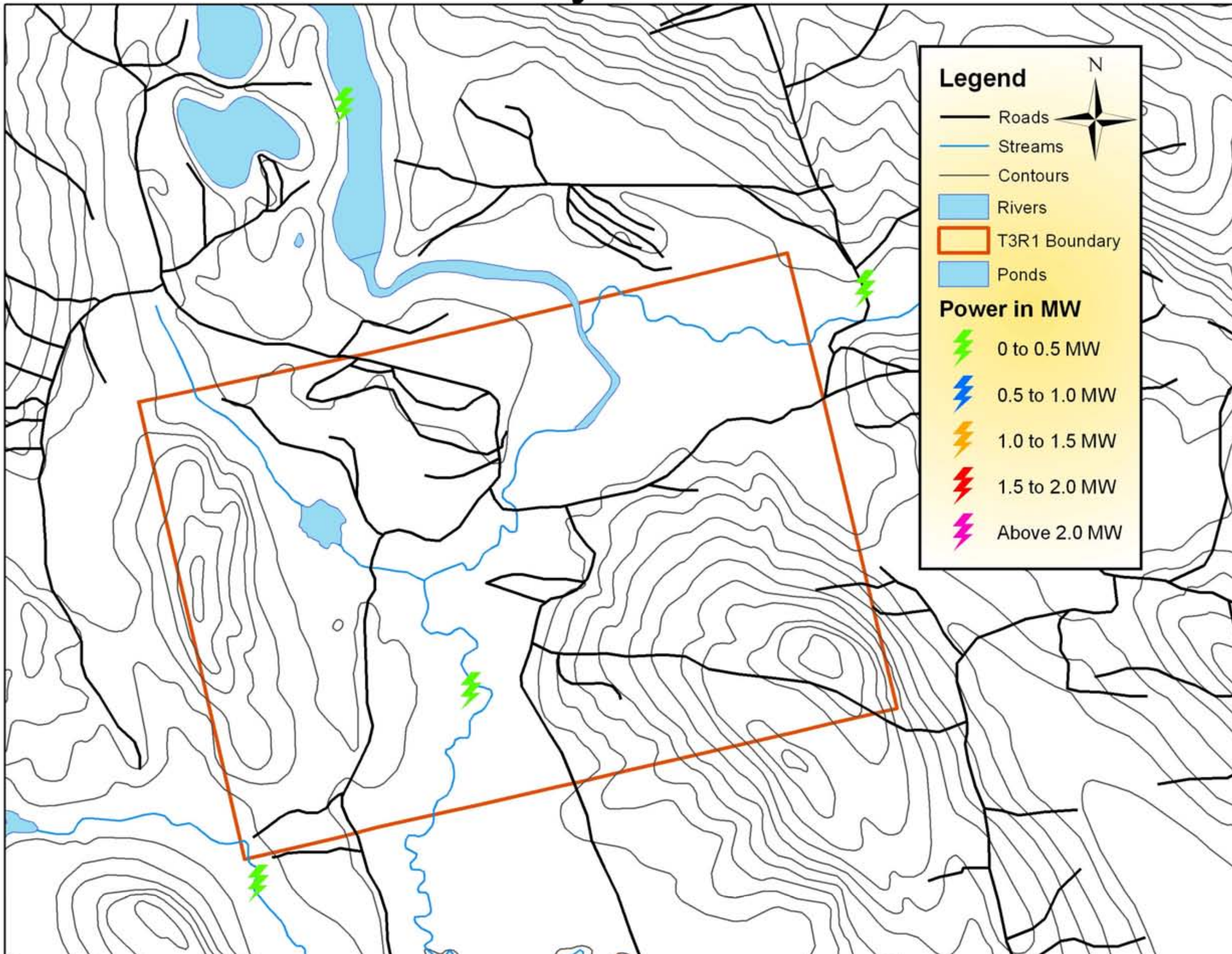
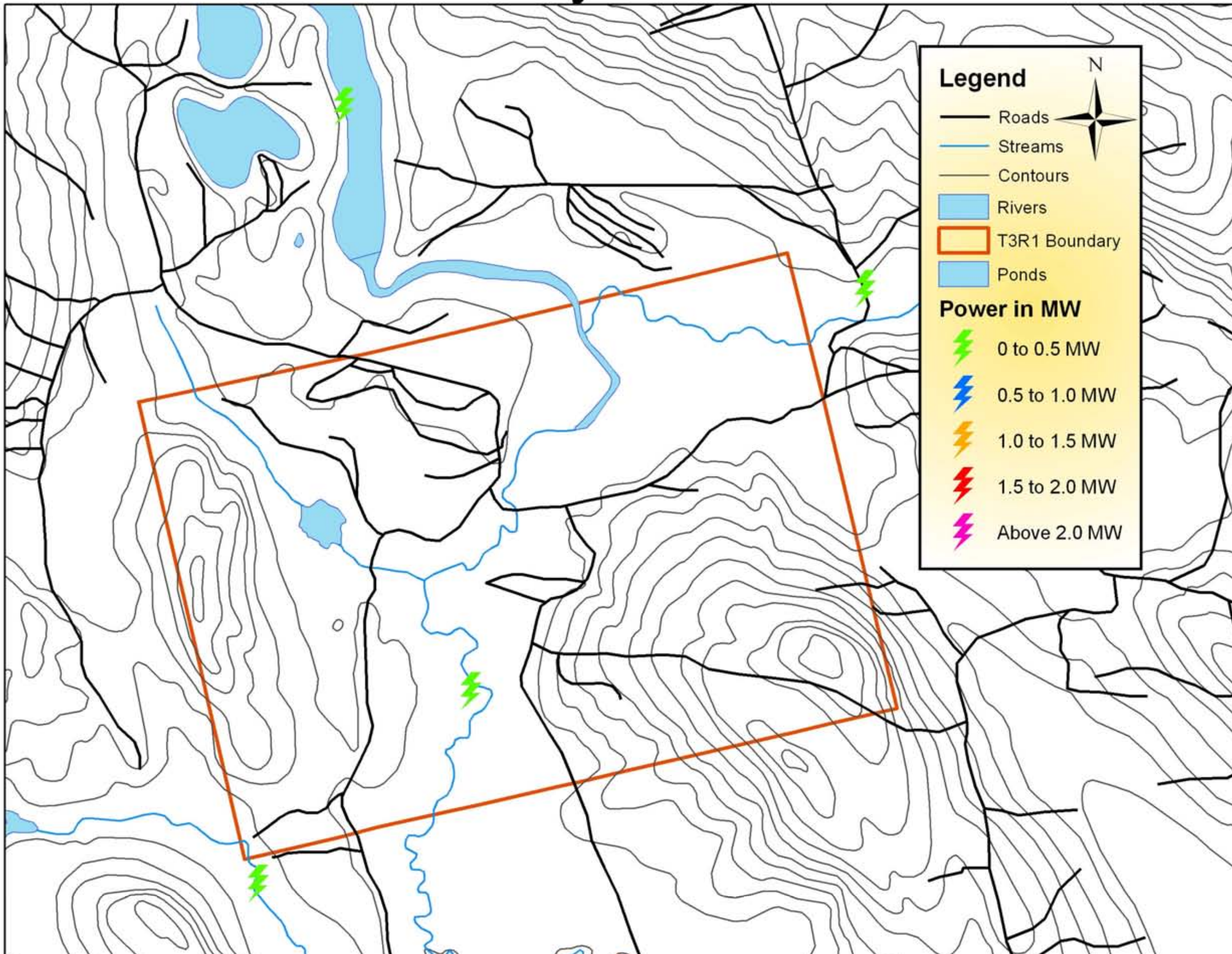


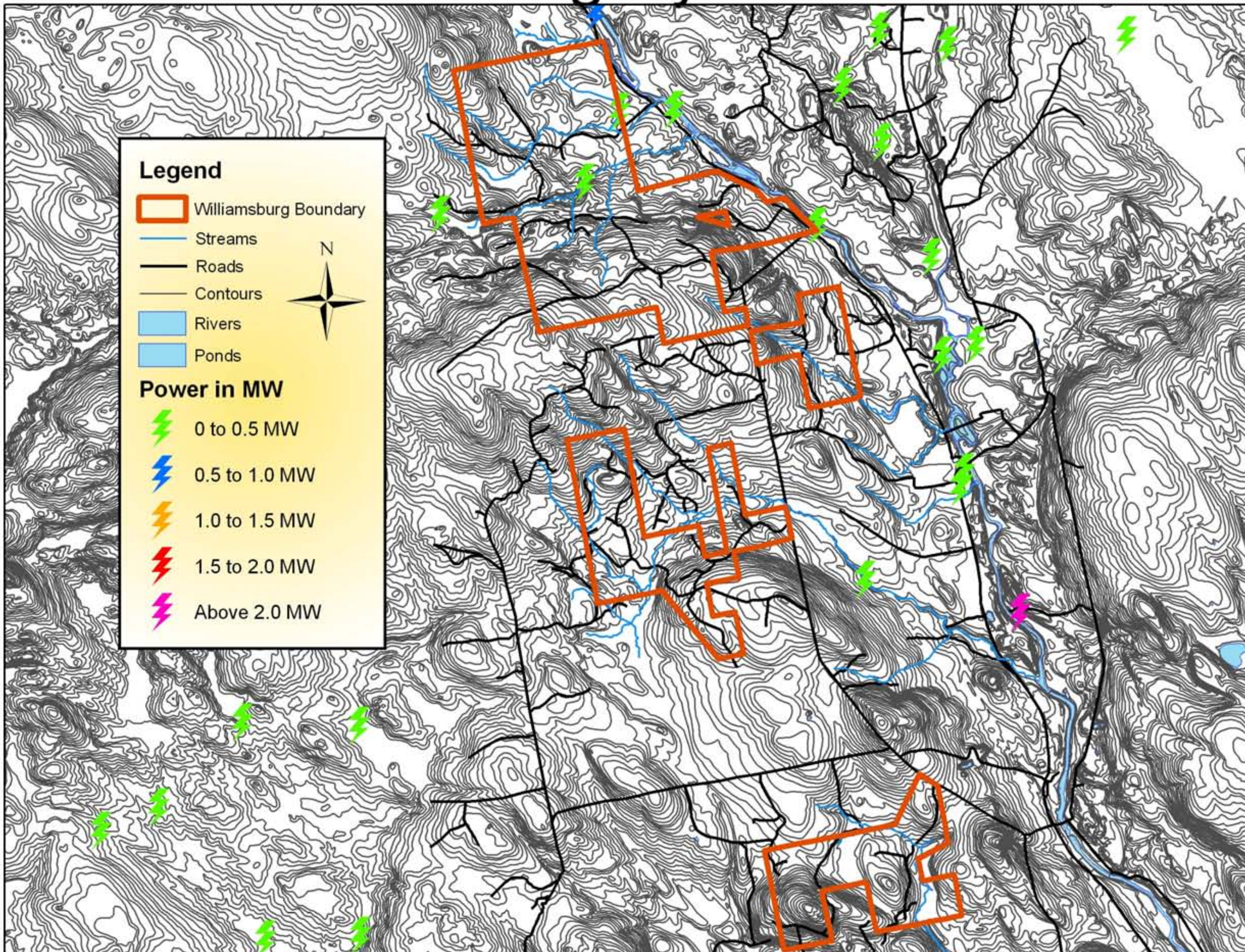
T3R1 Hydro Potential



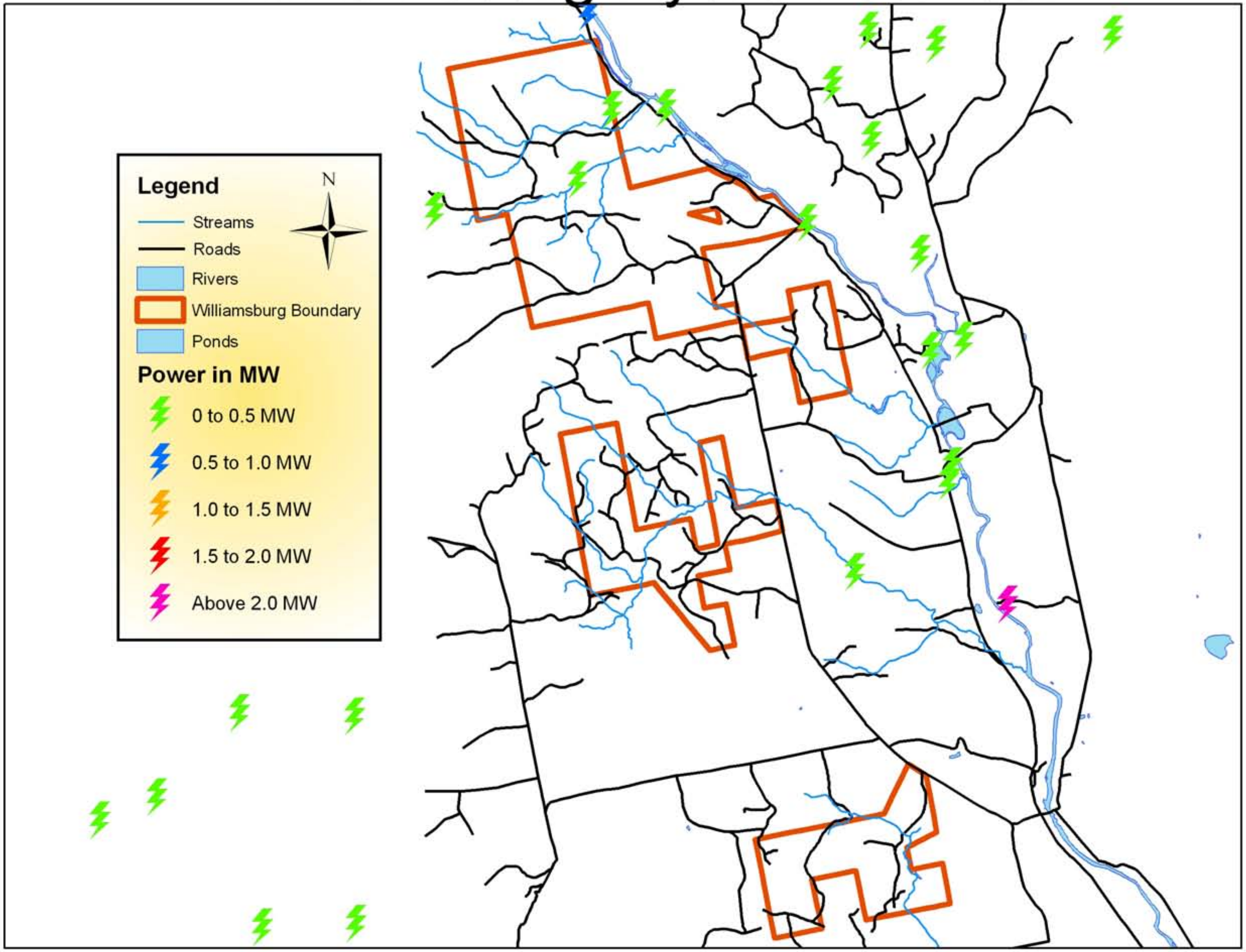
T3R1 Hydro Potential



Williamsburg Hydro Potential



Williamsburg Hydro Potential



Commercial Facility Energy Audits

Penobscot Indian Nation
Indian Island, Maine.

Alan R. Mulak, PE, LLC
July 11, 2006
U.S. DOE Grant DE-FG35-05GO15175, A000

Table of Contents

Disclaimer

The information contained within this report is based upon a walk-through assessment of the facility on the date of the audit. I have based my findings and suggestions on what I observed at the time, data I was provided with, studies performed by potential vendors, and in some cases what was provided to me anecdotally. The suggested courses of action are my opinion and in no way am I guaranteeing energy savings, installation, or performance.

Section 1 - Executive Summary

1.1 Introduction:

This report details the recommendations and conclusions of energy audits conducted at the thirteen largest commercial Penobscot Indian Nation facilities on March 27 and 28, 2006. This effort resulted from a contract between the Penobscot Indian Nation and Alan R. Mulak, PE for energy audit services dated February 27, 2006.

During the time on site, Alan R Mulak P.E., an independent consulting engineer working for the Penobscot Indian Nation had assistance from David Pardilla, Facility Manager, William Thompson, Air Quality Specialist, and Mike Sockalexis, Tribal Energy Coordinator. Also assisting was David Climo, Master Electrician with regards to lighting counts and estimates.

Section one of this study provides summary level information on findings, recommendations, and projected savings if all measures are implemented.

Section two of this study breaks out each facility separately and all are contained within. Each section includes recommendations for Energy Conservation Measures (ECM) addressing the electric, oil, and gas usage in the facilities. Details of the findings and recommendations are contained in their respective sections of this report.

A summary table showing energy savings, cost savings, implementation costs, and simple payback period for the recommended energy conservation measure considered is shown in the four sections that follow. Equipment specifications also known as “cut sheets” on recommended technologies have been included in the appendix. The cut sheets are included to offer an idea of the type of technology recommend…not the specific product.

Questions regarding this study should be directed to:

Alan Mulak, PE, LLC
Energy Engineer and Consultant
29 Ernie’s Drive
Littleton, MA 01460
(978) 486-4484
amulak@comcast.net

Note: This report was made possible by a grant from the U.S. Department of Energy. It is grant number DE-FG35-05GO15175, A000

1.2 Summary of Energy Conservation Measures:

The following table is a summary of all recommended Energy Conservation Measures (ECMs) for all thirteen studied facilities. When implementing these measures, it is recommended that this energy saving equipment be installed (where appropriate) in the smaller facilities as well.

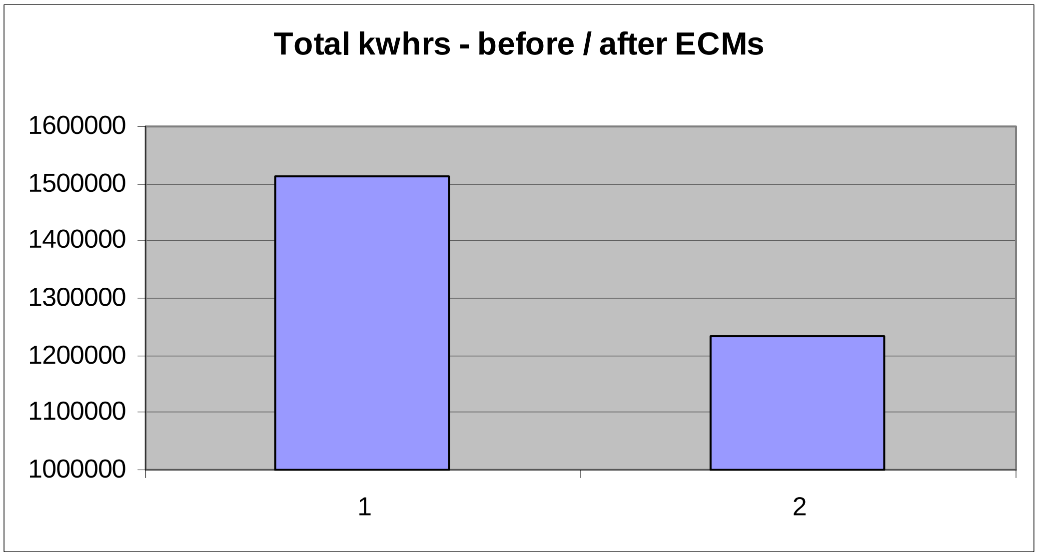
Chart 1.2.1 Summary ECMs

Measure	Annual Energy Savings (kwhr)	Demand Savings (KW)	Oil Savings (Gallons)	Propane Savings (Gallons)	Installed cost	Annual Cost Savings	Utility Rebate	Simple Payback (years)
ECM-1: Upgrade Lighting	165369	34	0	0	$ 117,365	$ 31,651	$ 28,512	2.8
ECM-2: Occupancy Sensors	41141	0	0	0	$ 17,950	$ 7,817	$ 8,050	1.3
ECM-3: Vendor Misers	20160	0	0	0	$ 1,925	$ 3,830	$ -	0.5
ECM-4: Setback Thermostats	21280	2	6791	1250	$ 17,150	$ 15,664	$ -	1.1
ECM-5: Cooler / Freezer Economizers	2500	0	0	0	$ 3,000	$ 475	$ -	6.3
ECM-6: Electric Motors	3518	1	0	0	$ 1,268	$ 675	$ 120	1.7
ECM-8: Tankless Water Heaters	24585	6	0	-150	$ 6,000	$ 4,459	$ -	1.3
Totals	278553	43	6791	1100	$ 164,658	$ 64,571	$ 36,682	2.0

1.3 Summary of Projected Economics

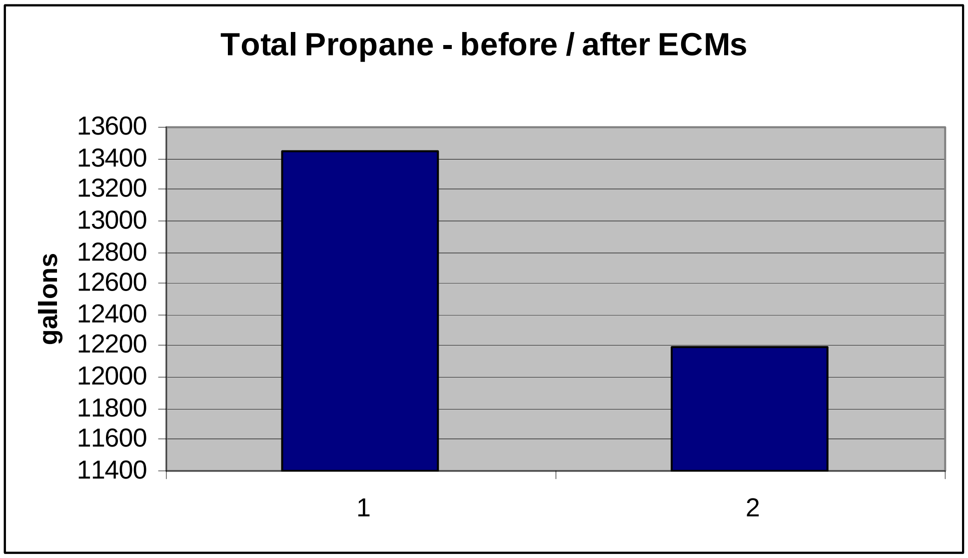
The following graphs and tables offer an estimation of energy savings and cash flow if all ECMs are implemented. These values assume no change in occupancy patterns or energy usage.

Graph 1.3.1 Total kwhrs



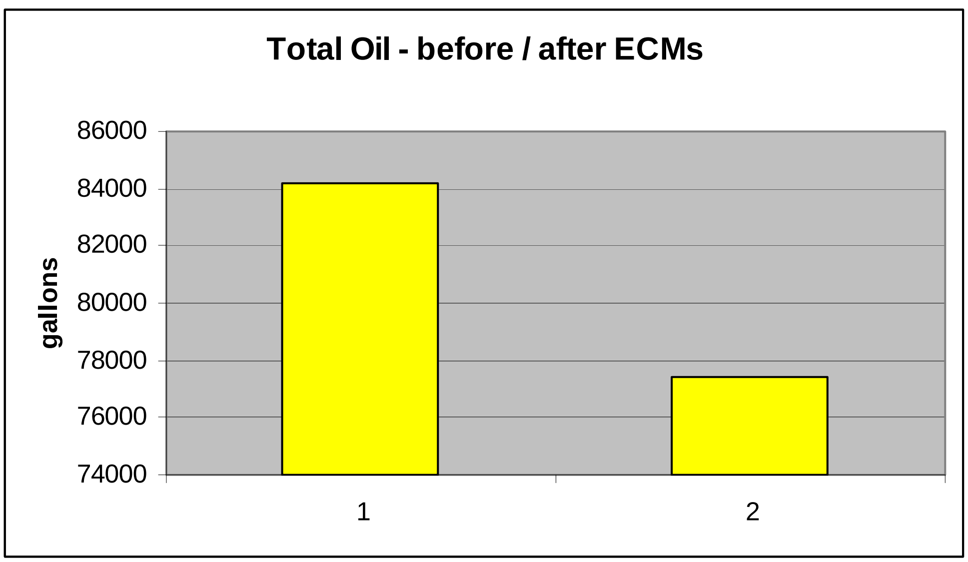
Graph 1.3.1 (above) illustrates the results in energy savings measured in kwhrs if all ECMs are implemented. The savings is estimated to be 278,553 kwhrs which at current Bangor Hydro electric rates amounts to $52,925 per year.

Graph 1.3.2 Total Propane



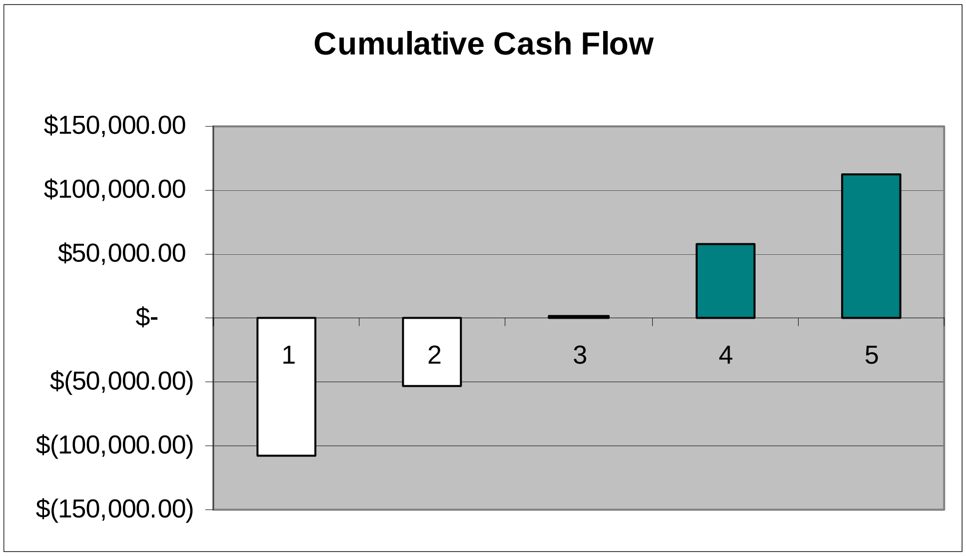
Graph 1.3.2 (above) illustrates the results in energy savings measured in gallons of propane if all ECMs are implemented. The savings is estimated to be 1,250 gallons which at current AmeriGas rates amounts to $2,099 per year.

Graph 1.3.3 Total Oil



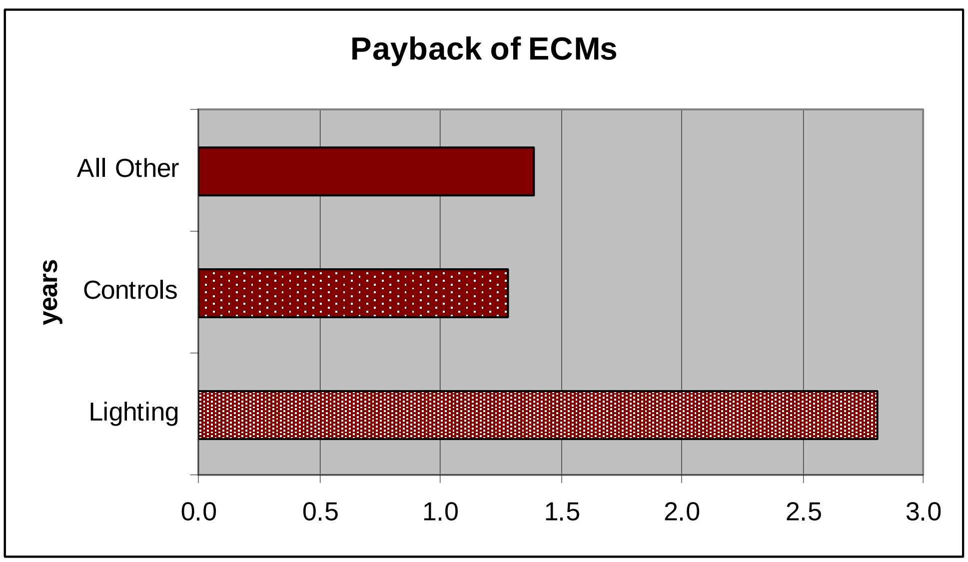
Graph 1.3.3 (above) illustrates the results in energy savings measured in gallons of oil if all ECMs are implemented. The savings is estimated to be 6,791 gallons which at contract rates of $1.40 per gallon amounts to $9,507 per year. Also, this estimated savings does not include savings from (1) actuator replacement and (2) roof repairs, both of which could result in significant oil savings.

Graph 1.3.4 Cash Flow



Graph 1.3.4 (above) illustrates the projected cash flow is all measures are implemented in the first year of the project. Based upon estimates, the break-even time period is roughly 2.05 years.

Graph 1.3.5 Simple Payback



Graph 1.3.5 (above) illustrates the calculated simple payback of the recommended ECMs. All SPBs are less than three years, thus excellent projects.

Chart 1.3.6 Oil Comparison

Oil Pricing Economics

Annual Usage	Gallons	Cost per Gal. $2.05	Cost per Gal. $1.40	Projected Savings
Current	84200	$172,610.00	$117,880.00	$54,730.00
After ECMs	77409	$158,688.45	$108,372.60	$64,237.40

Chart 1.3.6 (above) illustrates the difference between continued purchases of oil from R. H. Foster and the contracted amount of $1.40 / gallon from Venezuela.

1.4 Suggested Energy Conservation Measures Technologies and Equipment:

The following are the technologies and equipment recommended in the ECMs:

1. LED Exit Signs. The most common exit sign upgrade is to replace signs using incandescent and fluorescent bulbs with signs that use LED (high efficiency light emitting diode) bulbs. This retrofit both reduces energy use by up to 80% and lowers maintenance costs. One sign alone can save about $15-20 annually on electricity costs and can last up to 25 years without a lamp replacement. Replace all exit signs with LED exits, similar to one shown at right. In K-12 schools, Efficiency Maine offers a rebate on this technology.

2. High Performance T8 Lamps with Electronic Ballasts. Fluorescent lighting has improved over time. Switching from standard T12 (1-1/2 inch diameter) fluorescent tubes with magnetic ballasts to thinner T8 tubes with electronic ballasts will save over 40 percent in electricity usage. Ballasts are an essential part of fluorescent lamps. Magnetic ballasts are now being phased out in favor of more energy-efficient electronic ballasts Electronic ballasts have different starting characteristics depending on the specific use. These include rapid start, instant start, and program start varieties. The new "Super T8s" are more efficient than the standard T8s and Efficiency Maine offers a rebate on this technology.

3. Compact Fluorescent Lamps. Replacing incandescent bulbs with fluorescent lamps will save up to 75% of the electricity costs per lamp. Fluorescent lamps also last up to 10 times longer than incandescent bulbs and produce 90% less heat. Although the initial cost of CFLs is high relative to incandescent lamps, the energy savings and reduced

maintenance time and expense from lamp replacement make CFLs a cost-effective energy conservation measure for many applications. CFLs should be installed in areas with the heaviest use, such as hallways, stairwells, lobbies, and community areas. To obtain sufficient light levels, the wattage of the CFL should generally be one-third to one-fourth that of the incandescent it is replacing. If you are unfamiliar with the best CFL wattage to use for your lighting needs, determine the lumens (light output) of the current incandescent bulb and look for this lumen level when selecting the appropriate CFL. Efficiency Maine offers a rebate on this technology, as long as the fixtures are hard wired, not screw in.

4. Install T5 "High Bay" Fixtures. In the gymnasium, bingo hall, maintenance bays, and other high bay applications, replace the existing Metal Halide fixtures with T-5, High Output lamps and appropriate ballasts. This is new technology and the benefits of T-5s over traditional HID fixtures are well documented. In addition to the energy savings, the improvement in light quality will be significant. In several locations, existing Metal Halide lamps are nearing the end of their life and have faded to roughly 65% of their original light output. Along with the T5 fixtures, a ceiling mounted occupancy sensor is an absolute must and will essentially double the energy savings. Efficiency Maine offers a rebate on this technology.

5. Set back thermostats. Throughout the Island, the only significant energy controls in place are the facility operators. Heating, cooling, ventilation, and lighting are all operating without automatic controls. This practice becomes problematic and expensive when systems are inadvertently left "on" during "off" time periods. Frequently in facilities without automated controls, exhaust fans, heating and cooling devices, and various other equipment are not controlled and run 24/7 even during periods when they could be turned off. Even a simple 5/2 setback thermostat will all but eliminate this uncontrolled and very expensive practice.

6. <u>Occupancy Sensors</u>. All classrooms, rest rooms, and offices should have an occupancy sensor similar to the one shown at right. These are proven energy savers. There are a number of varieties and manufacturers of these devices but the most important criteria should be two sources of detection – IR and UV – which most quality devices employ. These devices come in two basic types – wall switch and ceiling mounted. They both have their advantages. Ceiling mount occupancy sensors are considered tamper proof and Efficiency Maine offers a rebate on this technology. Wall switch sensors can be over-ridden and thus are not eligible for a rebate. Within this report, it is assumed all sensors will be ceiling mount.

7. <u>Controls for vending machines</u>. Vending machine controls power down vending machines when the area surrounding it is unoccupied and automatically re-powers the vending machine when the area is reoccupied. Additionally, these controls monitor the ambient temperature while the vending machine is powered down. Using this information, these controls automatically power up the vending machine at appropriate intervals, independent of occupancy, to ensure that the vended product stays cold. These inexpensive devices should be installed on all vending machines. In K-12 Schools, Efficiency Maine offers a rebate on this technology.

8. <u>Cooler and Freezer Economizers</u>. The recommended walk in cooler and freezer economizers regulates the speed of the evaporator fan motors to meet the exact needs of the refrigeration cycle and runs the fans at full speed only as needed. This lowers energy costs and extends the life of the perishables and the equipment. Further, there is a system add-on which utilizes outdoor air when the winter temperatures are equal to those required for safe food storage. This add-on would be particularly beneficial for any coolers adjacent to exterior walls. These systems should be installed in all walk-in cooler / freezer equipment.

9. Tankless Hot Water Heaters. Replace existing electric hot water heaters with propane fired tankless DHW units. Installing a tankless water heater would eliminate the need to keep the existing electric hot water tanks "on" 24/7. These economical devices would easily handle the domestic hot water needs of all facilities. Tankless hot water heaters have no standby losses._A popular product, the Rinnai Continuum is up to 50 percent more energy efficient than a traditional natural gas water heater and up to 70 percent more efficient than an electric water heater. These products utilize on-demand water heater technology which is more efficient because it only heats water when it is needed.

Note: the greatest savings from this ECO will be realized when the existing electric hot water heaters are replaced at the end of their useful life, not via wholesale replacement.

10. NEMA Premium Efficiency Electric Motors. With the exception of the treatment facility, it appears as if all electric motors are of standard efficiency. NEMA Premium efficiency motors are generally 5 to 10% more efficient which results in a significant reduction in electric expenses. Motors such as those on the boiler circulation pumps which are 81% efficient run about 3000 hours per year. The cost of replacement with premium efficiency motors will be realized in energy savings in roughly two years. Efficiency Maine offers a rebate on this technology.

Note: the greatest savings from this ECO will be realized when existing motors are replaced upon burnout, not via wholesale replacement.

1.5 General Observations and Recommendations:

The 13 facilities studied in this report are typical of most small communities. Some are modern and in excellent shape, others are not so. The following are general observations and recommendations. More specific details can be found in the section of the report that follows. Also, these general findings have been offered in suggested priorities wherein the highest priority is recommended for immediate action, the second priority should be added to a future budget, and the lowest priority are contingent upon first and second priority recommendations being implemented.

1.5.1 Highest Priority

1. **Lighting Retrofit.** Throughout most facilities, old technology fluorescent T12, Metal Halide HID lighting, incandescent bulbs, and incandescent exits signs are in place. This technology has been replaced by more efficient, better colored, longer lasting lamps, ballasts, and fixtures. This report recommends the immediate retrofit as detailed in each facility studied. Efficiency Maine cash incentives are available High Performance Lighting lamps and ballasts for this project.

2. **Lighting Controls.** Perhaps the least intrusive ECM is the widespread installation of controls. These would apply to lighting via occupancy sensors and heat/air conditioning via set back thermostats. This report recommends the immediate installation of energy controls as detailed in each facility studied. Efficiency Maine cash incentives are available for the electrical portion of this project.

3. **Setback Thermostats.** This inexpensive, easy to program devices would eliminate the problem of heat (and in some cases, air conditioning) being left on overnight when the various building are unoccupied. The savings in oil and propane would be significant. Recommended are Honeywell (or equivalent) T1000 which are essentially a 5 day / 2 day setting – perfect for most PIN buildings.

4. **Actuator Replacement.** Actuators are the moving device inside wall thermostats. They generally need replacement every five years or so. They fail open which results in uncontrolled heating – an issue which anecdotally, is a widespread problem on the PIN. Costing lass than $10 each, the actuators in all thermostats older than 5 years could be changed in a few days. The energy savings potential is very great.

1.5.2 Second Priority

1. BOC training for O&M staff.

The Building Operator Certification training program is perfect for hands-on facility operators. It is offered in Maine once or twice each year. PIN facility operators would gain a great deal of practical knowledge by attending plus would be provided with valuable resources for more efficient facility operations. It can be offered on site and modified for regional issues if the minimum number of students sign up. More details can be found on the Northeast Energy Efficiency Partnership (NEEP) website at www.neep.org.

Without modifications or customization, the basic course consists of eight full days of training on the following topics:

- **101 - Building Overview**
- **102 – Energy Conservation**
- **103a – HVAC Systems**
- **103b – HVAC Controls**
- **104 – Lighting**
- **106 – Indoor Air Quality**
- **107 – Electrical systems**
- **111 – Energy Management Planning**

Efficiency Maine offers co-payment plans for this course. See more course details in the appendix.

2. Purchase, populate, and utilize a Preventative Maintenance and O&M Automated System.

Currently, all facility operations and maintenance are directed by David Pardilla, Facility Manager. This system is working very well as evidenced by the condition and performance of the buildings studied. However, this knowledge should be automated and tracked for trending and productivity purposes. A PM system would capture all maintenance tasks from the details of routine daily cleaning to schedule overhauls of major HVAC equipment. The O&M portion of an automated system would keep track of tasks, products, special notes, and other pertinent data needed to maximize efficiency and productivity.

One automated system to examine is produced by www.schooldude.com/. This easy to use system, originally designed for use by school building operators, has expanded to service all types of facilities, included municipal buildings. It has components connecting all major components of O&M and is recommended for consideration.

Typically, the major components of a PM system would contain features such as:

- Maintenance work order issuance and tracking on a regular schedule. Details of routine maintenance would be listed on daily work orders. Items such as cleaning, proper handling of potentially hazardous cleaning materials, checking operation of vent fans, replacing burn-out lamps and ballast, etc would all be included in any PM system chosen.
- Inventory verification and update in conjunction with the scheduling of work orders. Updated parts, costs, and material lists would be added to and maintained on the PM system. Inventory would be maintained by automatically issuing reorder slips for items used.
- Provides "reminder" services via coordination with existing calendars. This generally operates off "run-time" set points which yield work orders for equipment after a given number of run hours. These set points are available from the equipment specifications and tracked by completed work orders.
- Coordinates with existing maintenance/payroll/inventory control formats. All PM systems connect to purchasing, accounting, and payroll.
- Reminders to address steam traps, changing filters, and seasonal maintenance. All PM systems have a module for seasonal work such as storm window maintenance, cooling and heating system "tune-ups and check-ups," filter changes, etc.

Benefits from a PM system would include:

- Elimination of reliance upon one source of direction.
- Ease of tracking total PM costs by building component system
- Extends the life of equipment and building assets
- Improves building comfort
- Reduces the O&M costs (vs not performing PM tasks)
- An excellent memory!

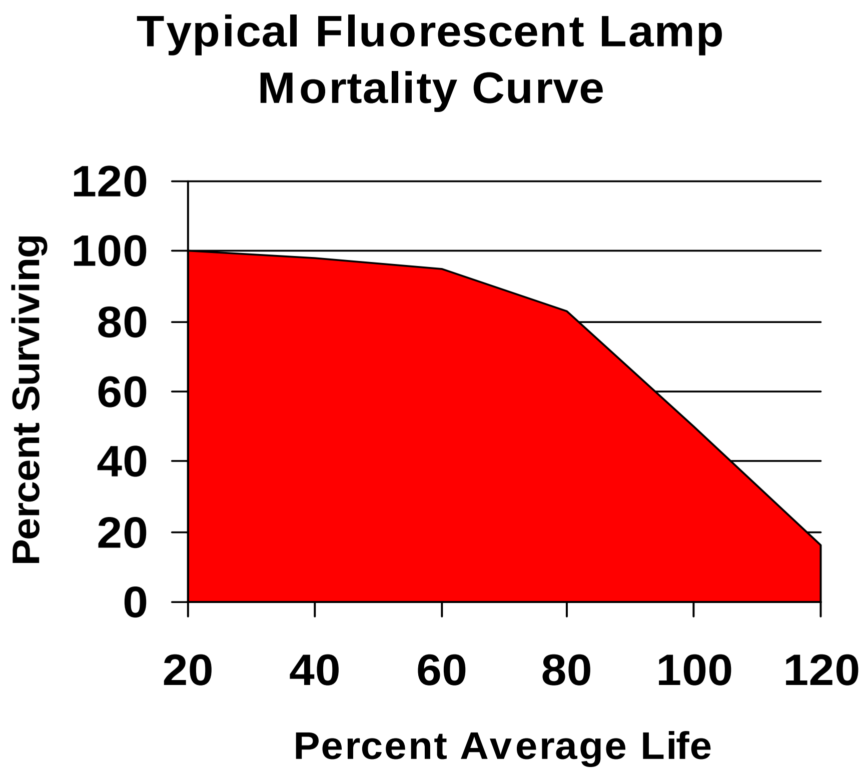
It takes at least two full years to create a useful, populated data base of PMs for an O&M staff to utilize. The time to start is ASAP.

3. Replace Standard Efficiency Motors upon burnout with NEMA Premium Efficiency Electric Motors.

With the exception of the treatment facility, it appears as if all electric motors are of standard efficiency. Premium efficiency motors are generally 5 to 10% more efficiency which results in a significant reduction in electric expenses. Motors such as those on the boiler circulation pumps which are 81% efficient run as much as 3000 hours per year. The cost of replacement with premium efficiency motors will be realized in energy savings in roughly two years. Efficiency Maine offers a rebate toward the purchase of these motors.
Note: the greatest savings from this ECO will be realized when existing motors are replaced upon burnout, not via wholesale replacement.

4. Lighting "group" relamping of Nick Sapiel Office in 2007 and Treatment Plant Facility in 2008.

In 2007, the existing lighting throughout the Nick Sapiel Office facility will be approaching the critical 75% point of the rated life. Studies have demonstrated the economic wisdom of conducting a group relamping at this point, thus avoiding increased labor expenses involved with changing random burnouts of ever increasing frequency after the 75% point. See the graph below.

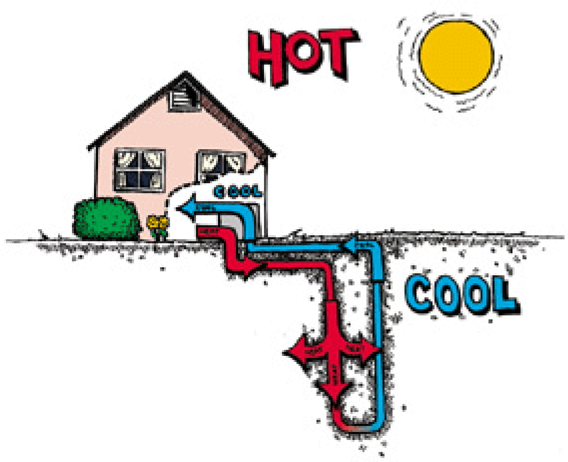


All CFLs should also be changed at the same time. The recommended replacement lamp/ballast would be a "super" T8. Efficiency Maine cash incentives are available High Performance Lighting lamps and ballasts for this project.

Repeat this action in the Treatment Plant Facility in 2008.

1.5.3 Future Consideration

1. **Geothermal Heat Pump for Nick Sapiel, Treatment, and PIN RX facilities.** Geothermal heat pumps can be a very efficient means to provide heating and cooling to some facilities. GHPs are similar to ordinary heat pumps, but use the ground instead of outside air to provide heating, air conditioning and, in most cases, hot water. Because they use the earth's natural heat, they are among the most efficient and comfortable heating and cooling technologies currently available. Ground source heat pumps can be categorized as having closed or open loops, and those loops can be installed in three ways: horizontally, vertically, or in a pond/lake. The type chosen depends on the available land areas and the soil and rock type at the installation site. These factors will help determine the most economical choice for installation of the ground loop. For closed loop systems, water or antifreeze solution is circulated through plastic pipes buried beneath the earth's surface. During the winter, the fluid collects heat from the earth and carries it through the system and into the building. During the summer, the system reverses itself to cool the building by pulling heat from the building, carrying it through the system and placing it in the ground. This process creates free hot water in the summer and delivers substantial hot water savings in the winter. Open loop systems operate on the same principle as closed loop systems and can be installed where an adequate supply of suitable water is available and open discharge is feasible. Benefits similar to the closed loop system are obtained. Per well, they can provide as much as 5 tons of cooling or heating. The Admin and PIN Rx facilities are prime candidates for the traditional GHP as they have both heating and cooling loads. The treatment facility could take advantage of well water already in place. All three facilities should first, take an aggressive approach to energy efficiency and "tighten" up the energy consumption as much as practical. Then, after all energy efficiency work is complete, an expert such as Turner Building Science should be called in for a free assessment of the project.

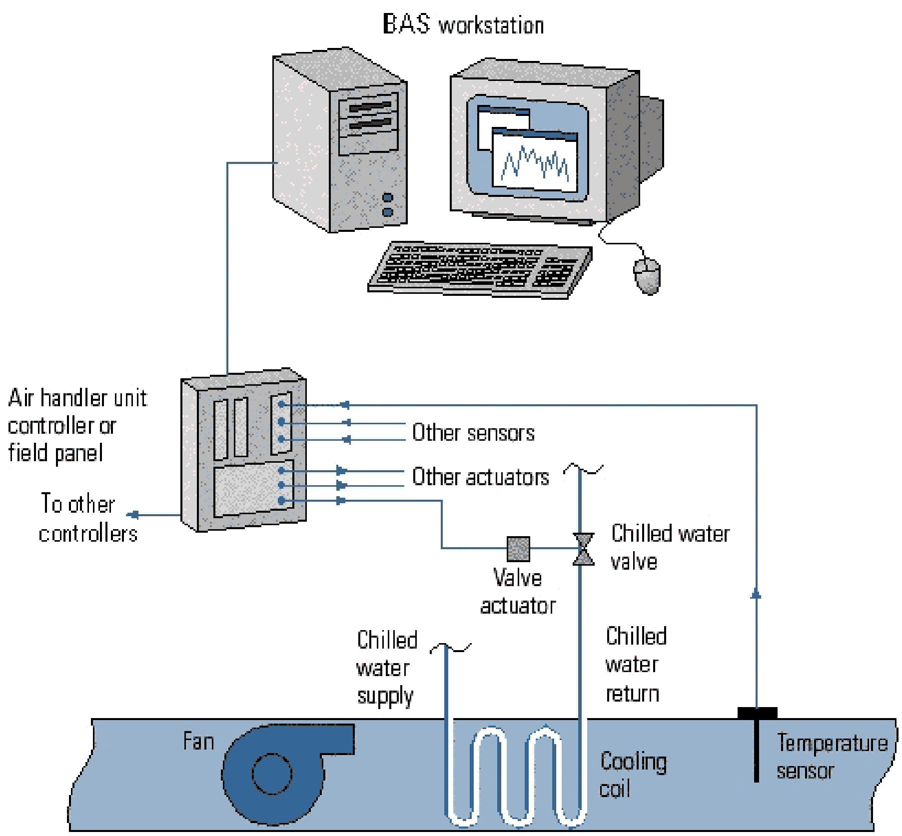


2. **Energy Star Building award for school.** Although the initial score for the Indian Island School was well below the qualifying grade of 75%, huge improvements can be expected once the suggested energy efficiency programs are implemented. Due to a large number of inefficient lighting sources, the relative lighting power density for this facility is very high. The ECMs would dramatically reduce this number, thus improving the score. Further, the lack of controls on all energy sources creates a situation wherein energy usage is unchecked. Gymnasium lighting (HID metal halide) is on from early morning to late evening, yet the gym is unoccupied 33% of the time. Controls can alleviate this wasteful practice. Thermostat actuators are in need of a complete change out as they fail in an open position…evident during the walk thru. Setback thermostats would automatically turn down the heat at night and weekends…something that is not currently being done. The qualifying score of 75% is not out of reach but much has to be done.

3. **New Roof for Community and Public Service buildings.** In both facilities, the roof is leaking and the insulation has been compromised and in some cases, removed altogether. New roofs are expensive but simultaneous with this project, new insulation and ventilation can be installed, thus improving the energy performance of both facilities as well as creating a more comfortable working environment.

4. **Upgrade wiring in Public Service building.** The existing wiring may be not be up to local code minimums. If the wiring is upgraded, it would be an excellent time to wire in occupancy sensors, setback thermostats, and modern lighting fixtures.

5. **Implement a wireless Energy Management System for all commercial facilities.** Once staff training and energy conservation measures have been implemented, consider installing an island wide wireless energy management system. A building automation system (BAS), also called an energy management system (EMS), controls energy-consuming equipment in a building to make it operate more efficiently while maintaining a comfortable environment. This system may include other features such as maintenance planning, fire- and physical-safety functions, and security services. Building automation systems, which are present in more than half of all buildings in the U.S. larger than 100,000 square feet, save an average of about 10 percent of overall building energy consumption. For older or poorly maintained buildings, the savings can be even greater. In addition to saving energy, these systems may also reduce the costs of overall building maintenance. Estimated cost of such a system: $150,000.



Section 2 – Findings for Individual Facilities

2.1 Nicholas H. Sapiel Jr. Office Facility

Address: 27 Wabanaki Way:

- One story office facility, basic block construction, covering 11,019 square feet.
- Roughly 5 years old, in excellent condition.
- Well maintained. Modern office facility with good windows and doors.
- Normal business hours of operation (roughly 40 hours per week).
- Heated and cooled by 4 Trane RTUs.
- The lighting is primarily T8 U tubes (2x2 fixtures) with some CFLs and LED exits.
- Electric DHW tank – 40 gallons. Uninsulated.
- Automated controls – none.

Recommended Energy Conservation Measures:

1. Dual sensing occupancy sensors for all offices, restrooms, and conference rooms.
2. Set back T'Stats for the four RTUs. Heat was on when building was entered at the beginning of the day. Controls are needed.

3. "Mizers" or similar controls on both vending machines shown at left. These should be installed on all vending machines.
4. Replace the existing unwrapped electric water heater with a propane tankless hot water heater.

Economics of Recommended ECMs:

Description: There are no lighting controls.

Recommendation: Install occupancy sensors in all offices, restrooms, and conference rooms.

	Count	Total Est. Cost $	Est Annual Savings kwhrs	Est Annual Savings $	Rebate $	Simple Payback (years)
	47	$5,170.00	5752.8	$1,070.02	$2,350.00	2.6
Totals	47	$5,170.00	5752.8	$1,070.02	$2,350.00	2.6

Description: There are automated controls on RTUs.

Recommendation: Install setback T'stats on RTUs

	Count	Total Est. Cost $	Est Annual Savings kwhrs	Est Annual Savings Propane	Est Annual Savings $	Rebate $	Simple Payback (years)
	4	$1,400.00	21280	1249.8	$5,053.20	$ 400.00	0.2
Totals	4	$1,400.00	21280		$5,053.20	$ 400.00	0.2

Description: There are no controls on vending machines.

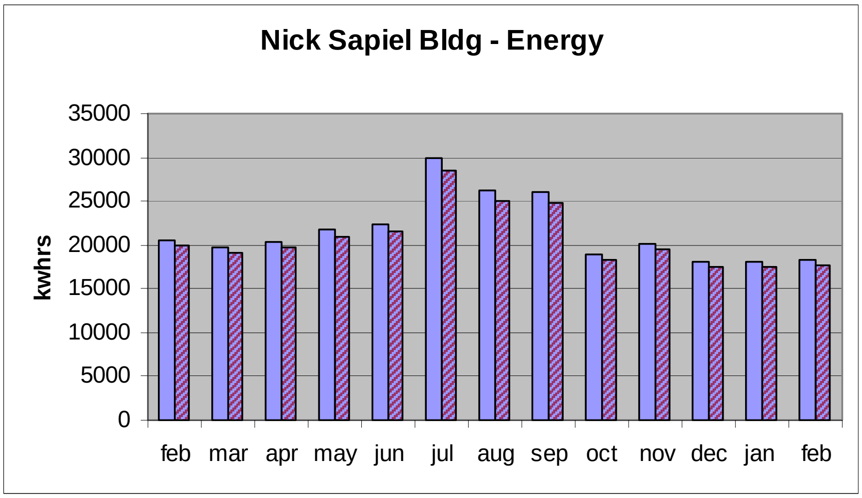
Recommendation: Install Vendor Misers

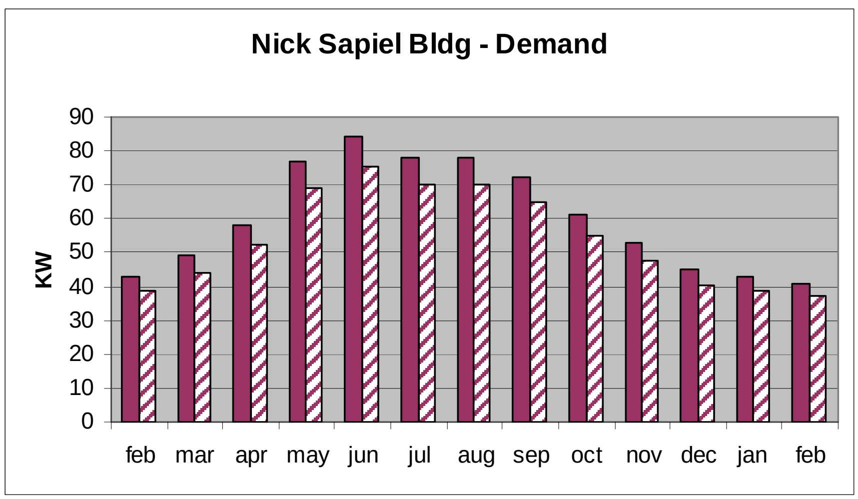
	Count	Total Est Cost $	Energy Savings kwhr	Annual Savings $	Utility Rebate $	Simple Payback (years)
	2	$ 350.00	2688	$ 500.00	$ -	0.7
Totals	**2**	**$350.00**	**2688**	**$500.00**	**$0.00**	**0.7**

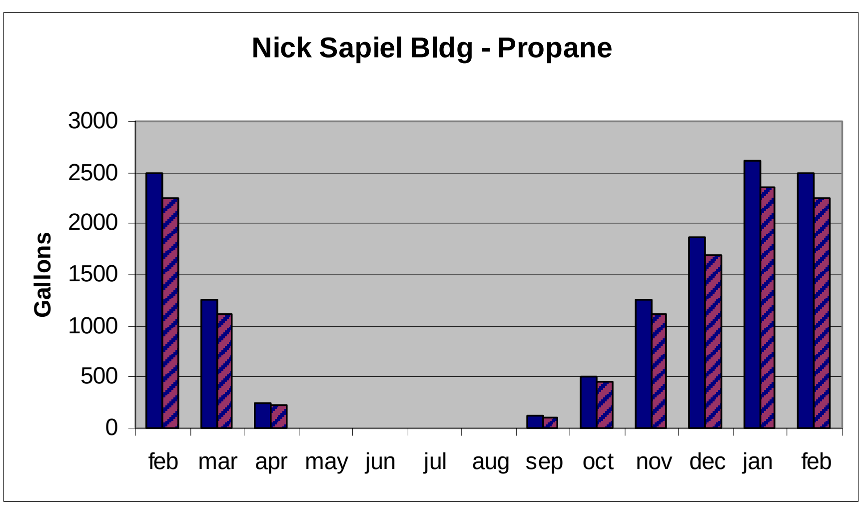
Recommendation:		Replace electric DHW tank with propane tankless				
	Count	Total Est Cost $	Energy Savings kwhr	Annual Savings $	Utility Rebate $	Simple Payback (years)
	1	$1,000.00	4097	$ 762.12	$ -	1.3
Totals	**1**	**$1,000.00**	**4097**	**$762.12**	**$0.00**	**1.3**

Billing Data per Energy Source:

The following graphs indicate energy use before and after proposed ECMs.







2.2 Indian Island School

Address: 10 Wabanaki Way

- One story school facility, basic block construction, covering 35,800 square feet.
- Doors and windows in good shape.
- Normal school hours of operation (roughly 45 hours per week).
- Heated by oil hot water boiler.
- The lighting is primarily T12s with HIDs in gym. No controls.
- Roughly 20 years old, in excellent condition.
- Walk in Cooler/Freezer in kitchen. No economizer.
- Automated controls – none.

Recommended Energy Conservation Measures:

1. Dual sensing occupancy sensors for all classrooms, offices, restrooms, and conference rooms.
2. Boiler night set back controls and / or set back thermostats.
3. Economizer on walk in cooler in kitchen.
4. Replace HID fixtures with T5HOs in gym.
5. Replace T12s with HPT8 systems.
6. Install LED exits.
7. Change actuators in classrooms.
8. Apply for an Energy Star Building award after the ECMs are implemented.

Economics of Recommended ECMs:

Scope: Most of the lighting is obsolete and inefficient. Replace as specified.

	Count	Total Est. Cost $	Energy Savings kwhr	Demand Savings KW	Annual Savings $	Utility Rebate $	Simple Payback (years)
1. Replace existing T12 lamps and ballasts with T8HP systems							
	471	$ -	28316	14.2	$ 11,891	$ 7,065	n/a
2. Replace existing incandescent bulbs with HWCFL							
	16	$ -	3020	1.5	$ 1,269	$ 192	n/a
3. Replace existing MH fixtures in gym with T5HOs							
	61	$ -	-5368	-2.7	$ (2,256)	$ 4,575	n/a
4. Replace existing exit signs with LED exits							
	6	$ -	1945	0.2	$ 3,255	$ 90	n/a
Totals:		**$ 36,453**	**27,913**	**13.2**	**$ 14,159**	**$ 11,922**	**1.7**

Description: There are no lighting controls.

Recommendation: Install occupancy sensors in all classrooms, gym and restrooms and conference rooms.

	Count	Total Est. Cost $	Est Annual Savings kwhrs	Est Annual Savings $	Rebate $	Simple Payback (years)
classrms	17	$1,870.00	8976	$1,669.54	$ 850.00	0.6
gym	1	$ 350.00	4095	$ 761.67	$ 50.00	0.4
Totals	18	$2,220.00	13071	$2,431.21	$ 900.00	0.5

Observation: The walk-in cooler/freezer runs uncontrolled

Recommendation: Install an Economizer

Number	Est Cost	Energy Savings kwhr	Annual Savings $	Utility Rebate $	Simple Payback Years
1	$3,000	2500	$ 475.00	$ -	6.3

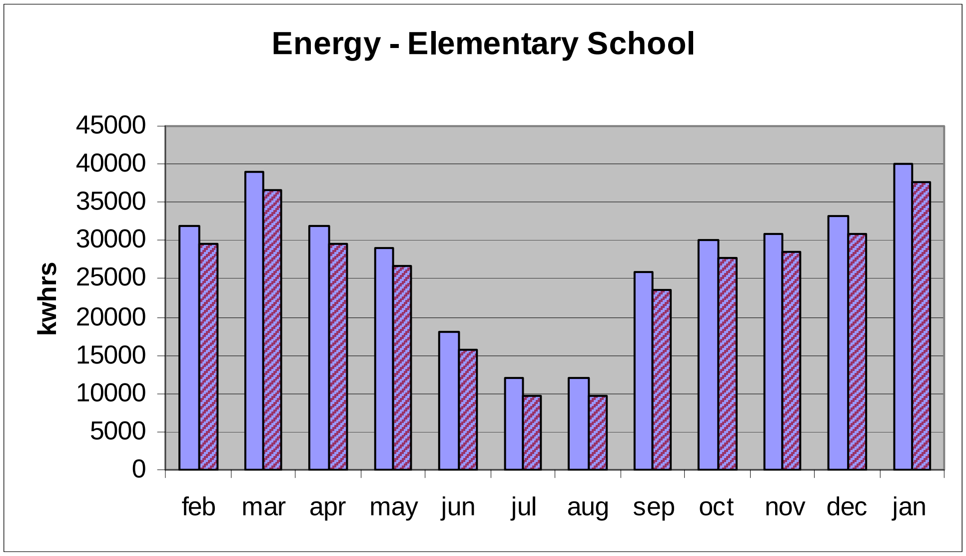
Description: There are automated controls on heating or cooling

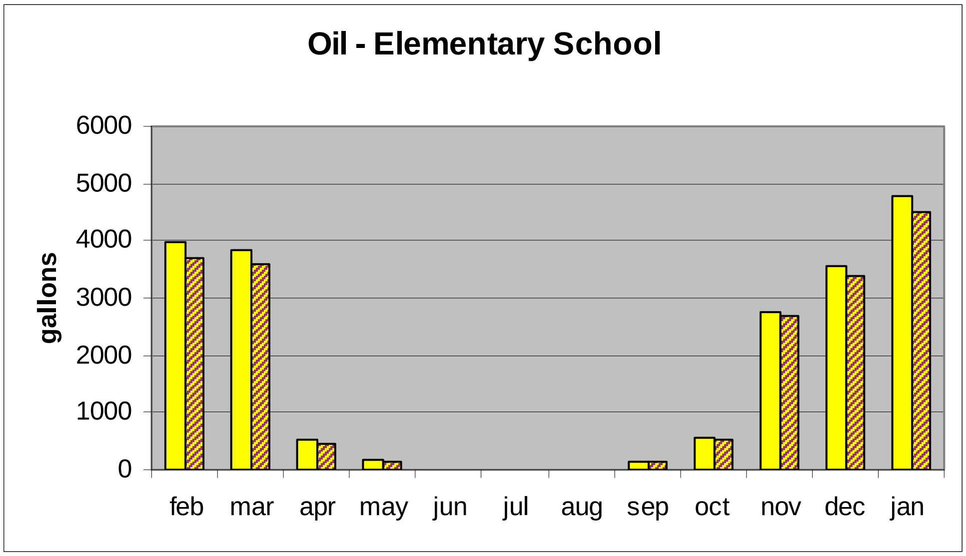
Recommendation: Install setback T'stats in each zone

	Count	Total Est. Cost $	Est Annual Savings kwhrs	Est Annual Savings Oil	Est Annual Savings $	Rebate $	Simple Payback (years)
	13	$4,550.00	0	2034.5	$2,848.30	$ -	1.6
Totals	13	$4,550.00	$ -	2034.5	$2,848.30	$ -	1.6

Billing Data per Energy Source:

The following graphs indicate energy use before and after proposed ECMs.





2.3 Maintenance Facility

<u>Address: 29 Wabanaki Way</u>

- One story garage facility, basic shed construction, covering 1,800 square feet.
- Normal business hours of operation (roughly 40 hours per week).
- Heated by oil hot water boiler and blowers.
- Electric strip in office.
- The lighting is primarily T12s and HIDs.
- Roughly 8 years old.
- Doors and windows in adequate condition.
- Automated controls – none.

<u>Recommended Energy Conservation Measures:</u>

1. Dual sensing occupancy sensor for office. Attach to strip heat as well as lighting.
2. Replace HID fixtures with T5HOs in vehicle bay.
3. Replace T12s with HPT8s.
4. Replace incandescent bulbs with HWCFLs.
5. Install LED exit signs.

Economics of Recommended ECMs:

Scope: Most of the lighting is obsolete and inefficient. Replace as specified.

	Count	Total Est. Cost $	Energy Savings kwhr	Demand Savings KW	Annual Savings $	Utility Rebate $	Simple Payback (years)
1. Replace existing T12 lamps and ballasts with T8HP systems							
	13	$ -	1269	0.3	$ 526	$ 195	n/a
2. Replace existing incandescent bulbs with HWCFL							
	2	$ -	353.6	0.2	$ 153	$ 24	n/a
3. Replace existing MH fixtures with T5HOs							
	4	$ -	832	0.4	$ 329	$ 300	n/a
4. Replace existing incand exit signs with LED exits							
	2		648	0.1	$ 1,085	$ -	n/a
Totals:		**$ 3,232**	**3103**	**1**	**$2,093.20**	**$ 519.00**	**1.3**

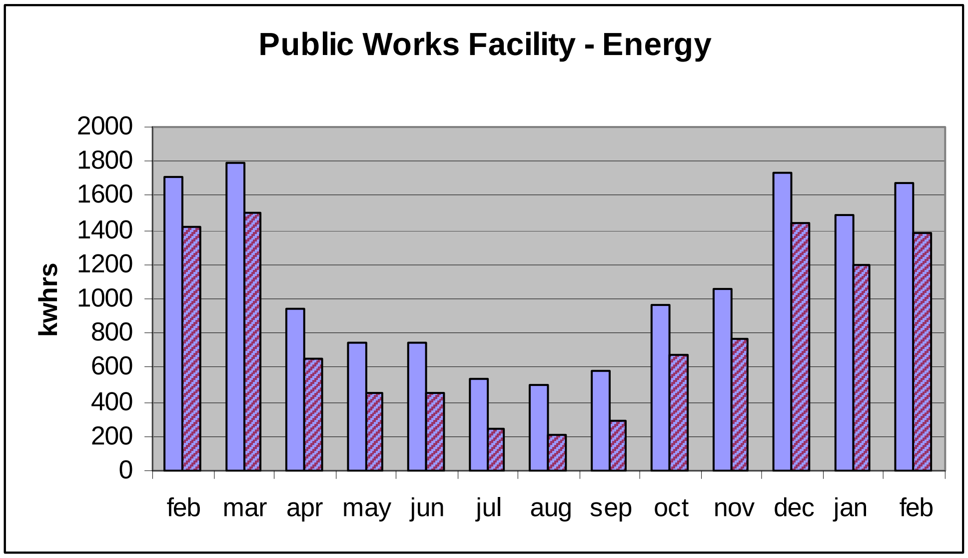
Description: There are no lighting controls.

Recommendation: Install occupancy sensor in office

	Count	Total Est. Cost $	Est Annual Savings kwhrs	Est Annual Savings $	Rebate $	Simple Payback (years)
gym	1	$ 110.00	391.04	$ 74.30	$ 50.00	0.8
Totals	1	$ 110.00	391.04	$ 74.30	$ 50.00	0.8

Billing Data per Energy Source:

The following graph indicates energy use before and after proposed ECMs.



2.4 Olamon Industries / PIN Rx

<u>Address: 31 Wabanaki Way</u>

- One story large garage facility, basic shed construction, covering 37,000 square feet.
- One portion unoccupied, the other side (PIN Rx) has normal business hours of operation (roughly 40 hours per week).
- The large empty area is heated by oil hot water boiler and blowers.
- The PIN-Rx area is heated via propane.
- The lighting is primarily T12s and HIDs.
- Roughly 20 years old.

Note: This report primarily focuses upon the occupied portion of the facility – PIN Rx. It is unclear as to the future use of the empty sections and thus, all energy consuming equipment could change with the change of occupancy. With this said, if nothing else is done and at a minimum, it is important to turn off the heat in the unoccupied warehouse until such time as the new tenants move in.

<u>Recommended Energy Conservation Measures:</u>

1. Dual sensing occupancy sensor for offices.
2. Replace HID fixtures with T5HOs in vehicle bay.
3. Replace T12s with HPT8s.
4. Replace incandescent bulbs with HWCFLs.
5. Replace exit signs with LED exits.
6. Turn off the heat in the unoccupied warehouse.

Economics of Recommended ECMs:

Scope: Most of the lighting is obsolete and inefficient. Replace as specified.

	Count	Total Est. Cost $	Energy Savings kwhr	Demand Savings KW	Annual Savings $	Utility Rebate $	Simple Payback (years)
1. Replace existing T12 lamps and ballasts with T8HP systems							
	34	$ -	4337	1.0	$ 2,197	$ 510	n/a
2. Replace existing MH fixtures with T5HOs							
	38	$ -	-3224	0.4	$ (1,717)	$ 2,850	n/a
3. Replace existing incand exit signs with LED exits							
	4	$ -	1296	0.2	$ 2,170	$ -	n/a
Totals:		**$ 7,976**	**2,409**	**2**	**$2,650.25**	**$3,360.00**	**1.7**

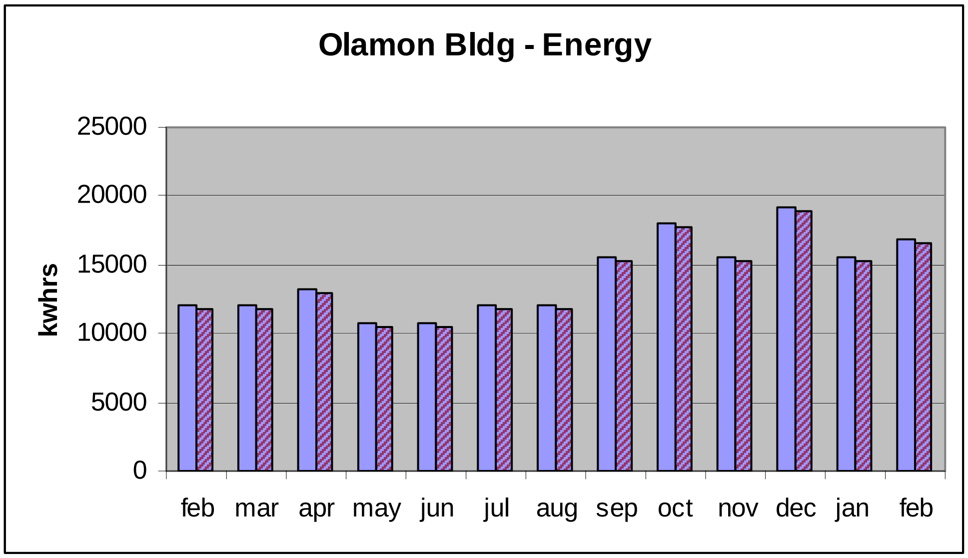
Description: There are no lighting controls.

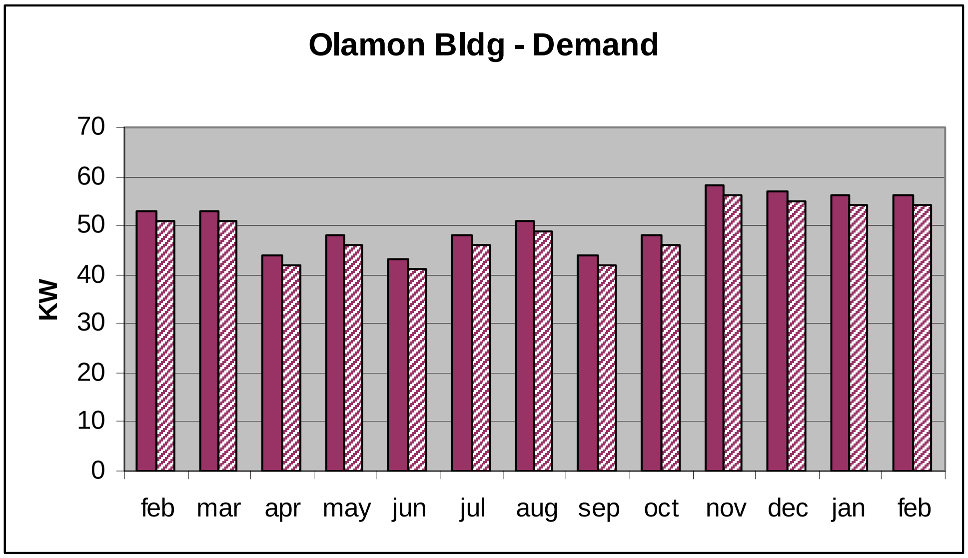
Recommendation: Install occupancy sensors in offices

	Count	Total Est. Cost $	Est Annual Savings kwhrs	Est Annual Savings $	Rebate $	Simple Payback (years)
	3	$ 330.00	1092	$ 207.48	$ 150.00	0.9
Totals	3	$ 330.00	1092	$ 207.48	$ 150.00	0.9

Billing Data per Energy Source:

The following graph indicates energy use before and after proposed ECMs.





2.5 Sockalexis Bingo Palace

<u>Address: 16 Wabanaki Way</u>

- One story large former hockey rink facility, basic shed construction, covering 125,000 square feet.
- Normal business hours of operation (roughly 40 hours per week). Far less is meeting area.
- Heated by oil hot water boiler and blowers.
- McQuay air cooled condensing unit to provide ventilation.
- The lighting is primarily T12s and HIDs.
- Roughly 25 years old.

<u>Recommended Energy Conservation Measures:</u>

1. Dual sensing occupancy sensor for offices.
2. Replace HID fixtures (shown at right) with T5HOs. This technology can operate with an occupancy sensor, thus eliminating the need to keep all the lights on for an extended period…even when the hall is empty.
3. Replace T12s with HPT8s.
4. Replace exit signs with LED exits.
5. “Mizers” or similar controls on both vending machines.

Economics of Recommended ECMs:

Scope: Most of the lighting is obsolete and inefficient. Replace as specified.

	Count	Total Est. Cost $	Energy Savings kwhr	Demand Savings KW	Annual Savings $	Utility Rebate $	Simple Payback (years)
1. Replace existing T12 lamps and ballasts with T8HP systems							
	108	$ -	9547	1.0	$ 5,012	$ 1,620	n/a
2. Replace existing MH fixtures with T5HOs							
	39	$ -	10140	0.4	$ 5,009	$ 2,925	n/a
3. Replace existing incand exit signs with LED exits							
	8	$ -	2593	0.2	$ 4,340	$ -	n/a
Totals:		**$ 21,266**	**22,280**	**2**	**$14,360.70**	**$4,545.00**	**1.2**

Description: There are no lighting controls.

Recommendation: Install occupancy sensors in offices

	Count	Total Est. Cost $	Est Annual Savings kwhrs	Est Annual Savings $	Rebate $	Simple Payback (years)
	8	$ 880.00	1560	$ 296.40	$ 400.00	1.6
Totals	8	$ 880.00	1560	$ 296.40	$ 400.00	1.6

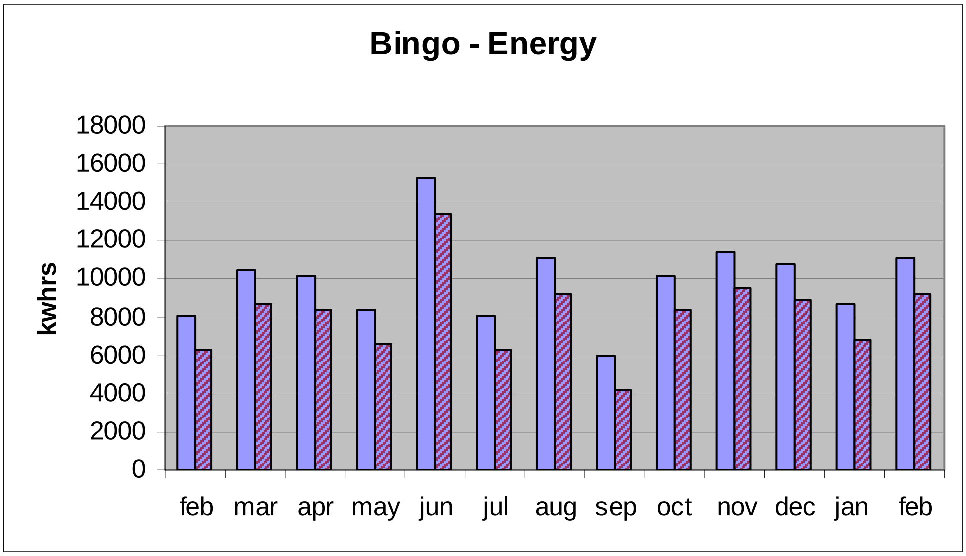
Description: There are no controls on vending machines.

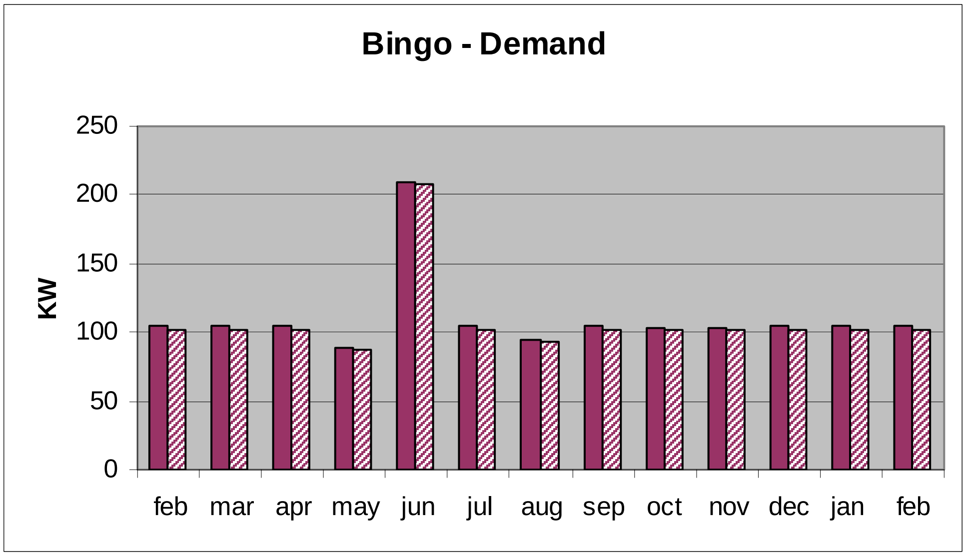
Recommendation: Install Vendor Misers

	Count	Total Est Cost $	Energy Savings kwhr	Annual Savings $	Utility Rebate $	Simple Payback (years)
	2	$ 350.00	2688	$ 510.72	$ -	0.7
Totals	**2**	**$350.00**	**2688**	**$510.72**	**$0.00**	**0.7**

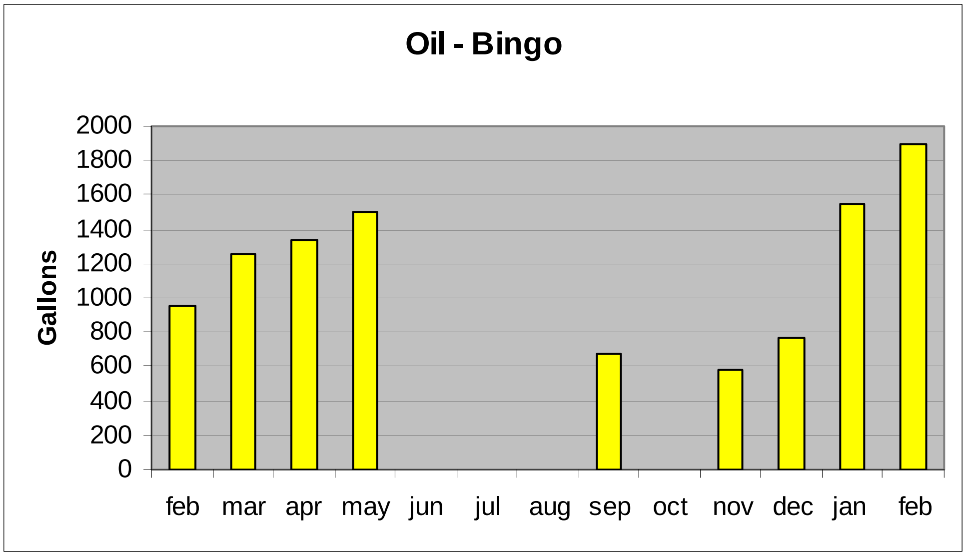
Billing Data per Energy Source:

The following graph indicates energy use before and after proposed ECMs.





Note: the spike in demand is due to both AC units being energized for summer bingo. If possible, it would be economically advantageous to schedule these annual events sometime other than the peak of the AC season.


Oil - Bingo
Gallons
2000
1800
1600
1400
1200
1000
800
600
400
200
0
feb
mar
apr
may
jun
jul
aug
sep
oct
nov
dec
jan
feb

2.6 Sewage Treatment Facility

<u>Address: 14 Wabanaki Way</u>

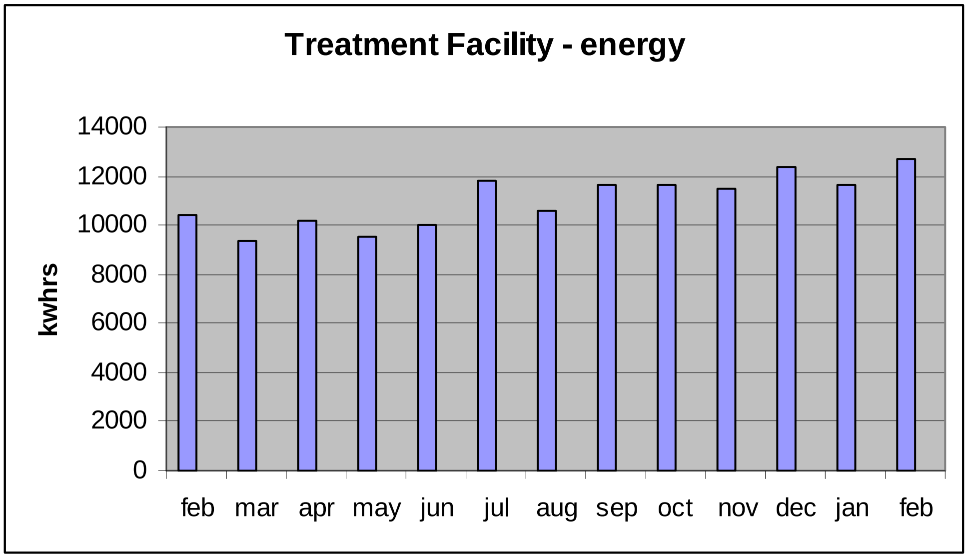
- One story recently renovated facilities, covering 5,000 square feet.
- Operates 24/7.
- Heated by oil hot water boiler.
- TTW AC units.
- The lighting is primarily T8s.
- Roughly 1 year old.
- VSDs and EEMs in place.
- Excellent condition.

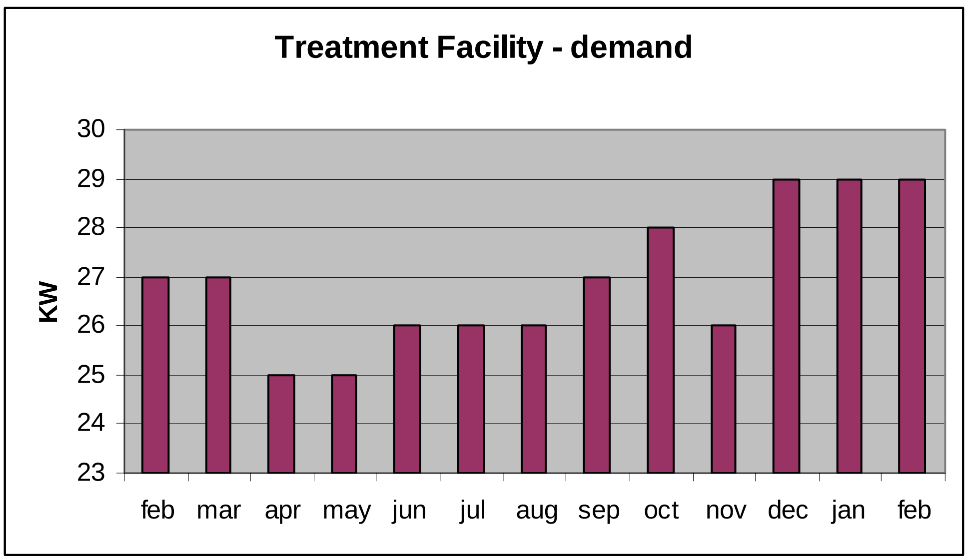
<u>Recommended Energy Conservation Measures:</u>

1. None

Billing Data per Energy Source:

The following graphs indicates energy and demand use.





2.7 PIN Government / Community Building

Address: 12 Wabanaki Way

- One story large shed design facility, basic shed construction, covering 24,400 square feet.
- Normal business hours of operation (roughly 40 hours per week).
- Heated by oil hot water boiler and blowers.
- The Weil McLain boiler is old.
- 2-5HP circ pumps/motors. Standard efficiency.
- AH's for AC. No controls.
- The lighting is primarily T12s and HIDs. No controls.
- Roughly 25 years old.
- Vending Machines – 4.
- Doors and windows in rough shape, leaky and do not close properly.
- The roof leaks and because of this, the insulation is marginal at best.

Recommended Energy Conservation Measures:

1. Dual sensing occupancy sensor for offices and rest rooms.
2. Replace HID fixtures with T5HOs.
3. Replace T12s with HPT8s.
4. Replace exit signs with LED exits.
5. "Mizers" or similar controls on both vending machines.
6. Replace motors with NEMA premium efficiency upon burnout.
7. Setback thermostats.
8. Suggested infrastructure improvements for the future:
    - Roof
    - Insulation
    - Doors
    - Windows
    - AH for ventilation
    - Boiler
    - Ground source heat pump to supplement heat and cooling.

Economics of Recommended ECMs:

Scope: Most of the lighting is obsolete and inefficient. Replace as specified.

	Count	Total Est. Cost $	Energy Savings kwhr	Demand Savings KW	Annual Savings $	Utility Rebate $	Simple Payback (years)
1. Replace existing T12 lamps and ballasts with T8HP systems							
	114	$ -	22164	1.9	$ 13,711	$ 1,710	n/a
2. Replace existing MH fixtures with T5HOs							
	24	$ -	7488	0.4	$ 4,632	$ 1,800	n/a
3. Replace existing incand exit signs with LED exits							
	19	$ -	6158	0.2	$ 10,306	$ -	n/a
4. Replace existing incand bulbs with HW-CFLs							
	19	$ -	3210	2.0	$ 1,986.03	$ 228.00	n/a
Totals:		**$ 17,322**	**39,021**	**5**	**30,636**	**3,738**	**0.44**

Description: There are no lighting controls.

Recommendation: Install occupancy sensors in offices

	Count	Total Est. Cost $	Est Annual Savings kwhrs	Est Annual Savings $	Rebate $	Simple Payback (years)
	19	$2,090.00	4446	$ 844.74	$ 950.00	1.3
Totals	19	$2,090.00	4446	$ 844.74	$ 950.00	1.3

Description: There are no controls on vending machines.

Recommendation: Install Vendor Misers

	Count	Total Est Cost $	Energy Savings kwhr	Annual Savings $	Utility Rebate $	Simple Payback (years)
	4	$ 700.00	5376	$ 1,021.44	$ -	0.7
Totals	**4**	**$700.00**	**5376**	**$1,021.44**	**$0.00**	**0.7**

Description: There are automated controls on heating or cooling

Recommendation: Install setback T'stats in each zone

	Count	Total Est. Cost $	Est Annual Savings kwhrs	Est Annual Savings Oil	Est Annual Savings $	Rebate $	Simple Payback (years)
	12	$4,200.00	0	2383.1	$ 3,336.34	$ -	1.3
Totals	12	$4,200.00	$ -	2,383.1	$ 3,336.34	$ -	1.3

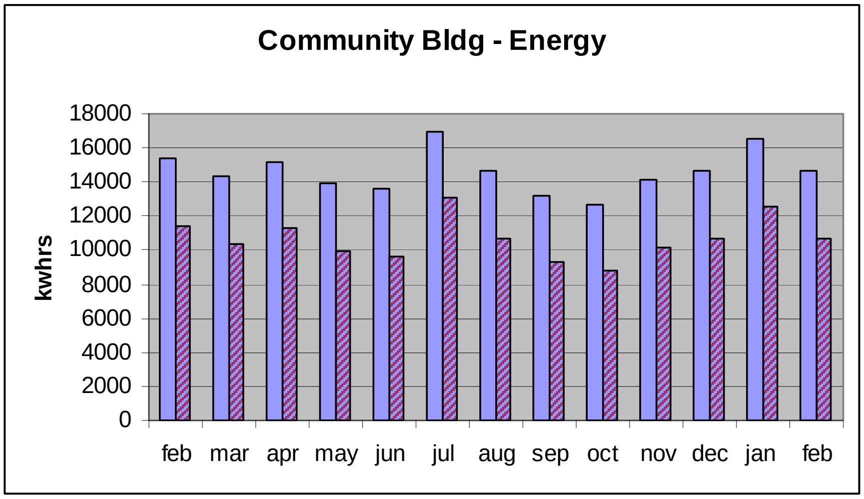
Description: Circ pump motors are standard efficiency.

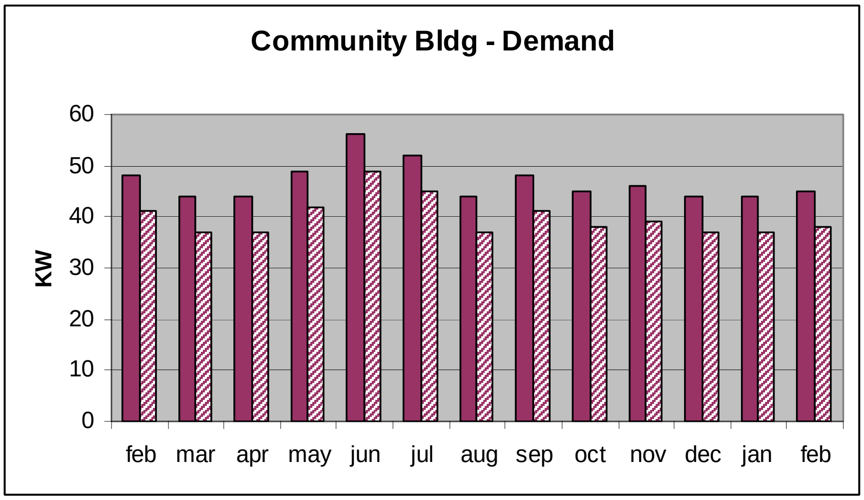
Recommendation: Upon burnout, replace with NEMA premium efficiency

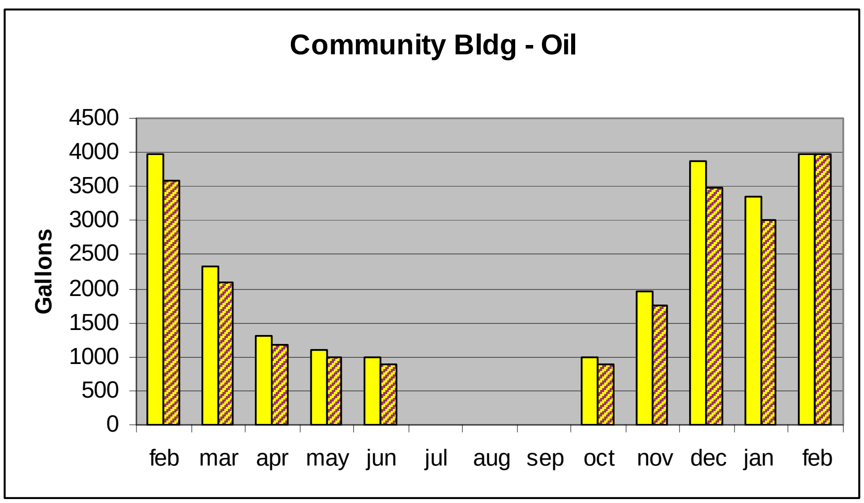
	Count	Total Est Cost $	Energy Savings kwhr	Annual Savings $	Utility Rebate $	Simple Payback (years)
	2	$1,268.00	3518	$ 622.00	$ 120.00	1.8
Totals	**2**	**$1,268.00**	**3518**	**$622.00**	**$120.00**	**1.8**

Billing Data per Energy Source:

The following graph indicates energy use before and after proposed ECMs.







2.8 Public Safety Facility

Address: 25 Wabanaki Way

- One story wood frame facility covering 5,460 square feet.
- Housing the police and fire departments, it operates 24/7.
- Heated by oil hot water boiler.
- TTW AC units.
- The lighting is primarily T12s
- Roughly 15 years old.
- Vending Machines – 2
- Poor ventilation and minimal insulation.
- New roof needed as soon as practical.
- Wiring suspect.
- No controls.

Recommended Energy Conservation Measures:

1. Dual sensing occupancy sensor for offices.
2. Replace T12s with HPT8s.
3. Replace exit signs with LED exits.
4. “Mizers” or similar controls on both vending machines.

Economics of Recommended ECMs:

Scope: Most of the lighting is obsolete and inefficient. Replace as specified.

	Count	Total Est. Cost $	Energy Savings kwhr	Demand Savings KW	Annual Savings $	Utility Rebate $	Simple Payback (years)
1. Replace existing T12 lamps and ballasts with T8HP systems							
	16	$ -	6517.44	0	$10,847.63	$ 240.00	n/a
2. Replace existing incand exit signs with LED exits							
	3	$ -	972.36	0	$ 1,618.40	$ -	n/a
3. Replace existing incand bulbs with CFLs							
	6	$ -	2260.08	0	$ 3,761.68	$ 72.00	n/a
Totals:		$3,002.00	9749.88	0	$16,227.70	$ 312.00	0.17

Description: There are no lighting controls.

Recommendation: Install occupancy sensors in offices

	Count	Total Est. Cost $	Est Annual Savings kwhrs	Est Annual Savings $	Rebate $	Simple Payback (years)
	4	$ 440.00	1576.8	$ 299.59	$ 200.00	0.8
Totals	4	$ 440.00	1576.8	$ 299.59	$ 200.00	0.8

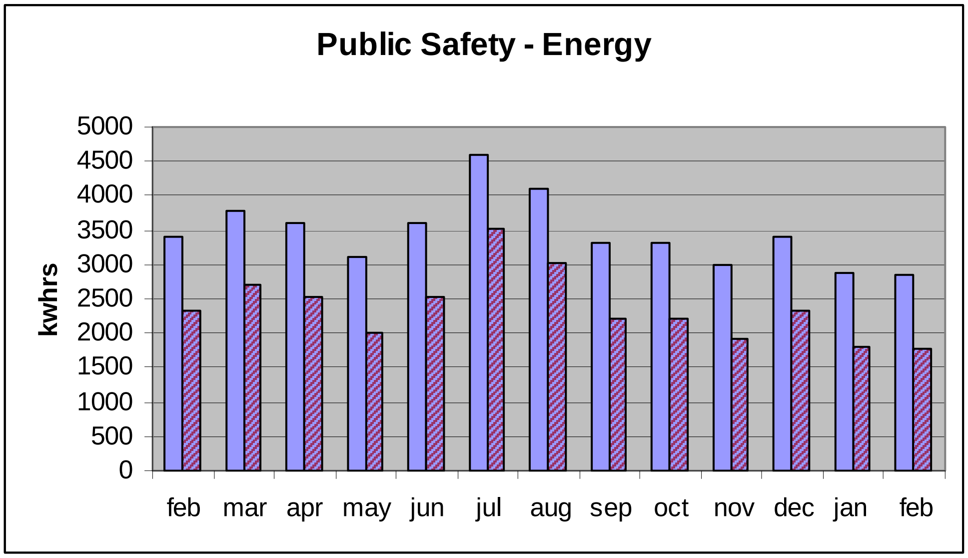
Description: There are no controls on vending machines.

Recommendation: Install Vendor Misers

	Count	Total Est Cost $	Energy Savings kwhr	Annual Savings $	Utility Rebate $	Simple Payback (years)
	4	$ 700.00	5376	$1,021.44	$ -	0.7
Totals	**4**	**$700.00**	**5376**	**$1,021.44**	**$0.00**	**0.7**

Billing Data per Energy Source:

The following graph indicates energy use before and after proposed ECMs.



2.9 Human Services Facility

<u>Address: 9 Wabanaki Way</u>

- One story wood frame facility covering 2,200 square feet.
- Operates 40 h/wk.
- Heated by oil hot water boiler.
- TTW AC units.
- The lighting is primarily T12s
- Roughly 20 years old.
- Vending Machines – 1
- Electric hot water. Minimal use.

<u>Recommended Energy Conservation Measures:</u>

1. Dual sensing occupancy sensor for offices.
2. Replace T12s with HPT8s.
3. Replace exit signs with LED exits.
4. “Mizers” or similar controls on both vending machines.

Economics of Recommended ECMs:

Scope: Most of the lighting is obsolete and inefficient. Replace as specified.

	Count	Total Est. Cost $	Energy Savings kwhr	Demand Savings KW	Annual Savings $	Utility Rebate $	Simple Payback (years)
1. Replace existing T12 lamps and ballasts with T8HP systems							
	16	$ -	1532.64	1.9459	$ 659.78	$ 240.00	n/a
2. Replace existing incand exit signs with LED exits							
	3	$ -	972.36	0.24827	$1,627.33	$ -	n/a
3. Replace existing incand bulbs with CFLs							
	6	$ -	531.48	1.95261	$ 228.80	$ 72.00	n/a
Totals:		$3,002.00	3036.48	4.14678	$2,515.91	$ 312.00	1.1

Description: There are no lighting controls.

Recommendation: Install occupancy sensors in offices

	Count	Total Est. Cost $	Est Annual Savings kwhrs	Est Annual Savings $	Rebate $	Simple Payback (years)
	4	$ 440.00	370.8	$ 70.45	$ 200.00	3.4
Totals	4	$ 440.00	370.8	$ 70.45	$ 200.00	3.4

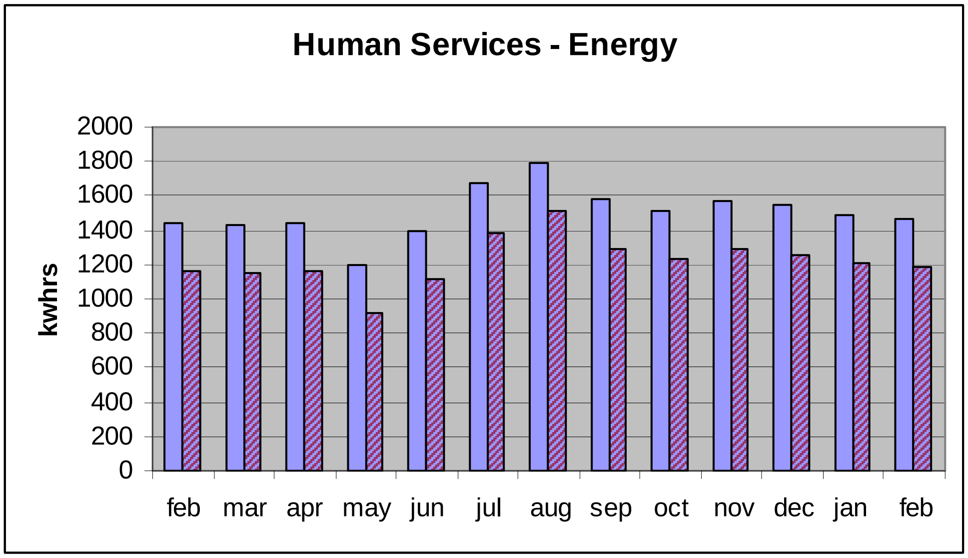
Description: There are no controls on vending machines.

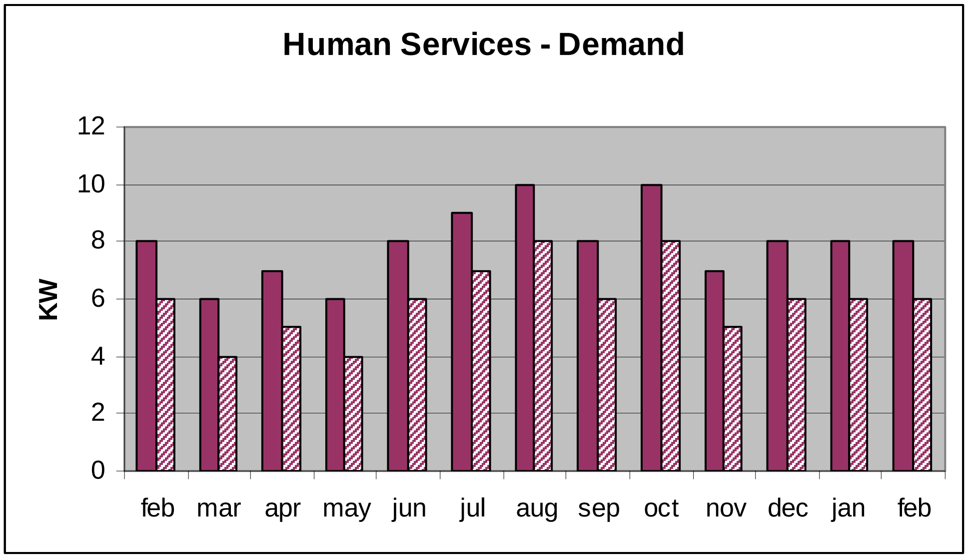
Recommendation: Install Vendor Misers

	Count	Total Est Cost $	Energy Savings kwhr	Annual Savings $	Utility Rebate $	Simple Payback (years)
	1	$ 175.00	1344	$ 255.36	$ -	0.7
Totals	**1**	**$175.00**	**1344**	**$255.36**	**$0.00**	**0.7**

Billing Data per Energy Source:

The following graphs indicate energy and demand use before and after proposed ECMs.





2.10 Indian Health Services Facility

<u>Address: 23 Wabanaki Way</u>

- One story wood frame facility covering 18,700 square feet.
- Operates 40 h/wk and in some areas, 24/7.
- Heated by oil hot water boiler.
- TTW AC units.
- The lighting is primarily T12s
- Roughly 25 years old.
- Vending Machines – 1
- Electric hot water

<u>Recommended Energy Conservation Measures:</u>

1. Dual sensing occupancy sensor for offices.
2. Replace T12s with HPT8s.
3. Replace exit signs with LED exits.
4. “Mizers” or similar controls on both vending machines.
5. Change actuators in thermostats.
6. Set back T’Stats for each zone.

Economics of Recommended ECMs:

Scope: Most of the lighting is obsolete and inefficient. Replace as specified.

	Count	Total Est. Cost $	Energy Savings kwhr	Demand Savings KW	Annual Savings $	Utility Rebate $	Simple Payback (years)
1. Replace existing T12 lamps and ballasts with T8HP systems							
	154	$ -	17113.2	1.9459	$ 8,983.90	$2,310.00	n/a
2. Replace existing incand exit signs with LED exits							
	9	$ -	2917.08	0.24827	$ 4,882.00	$ -	n/a
3. Replace existing incand bulbs with CFLs							
	4	$ -	551.2	1.95261	$ 289.36	$ 48.00	n/a
Totals:		$10,102.00	20581.48	4.14678	$14,155.27	$2,358.00	0.5

Description: There are no lighting controls.

Recommendation: Install occupancy sensors in offices

	Count	Total Est. Cost $	Est Annual Savings kwhrs	Est Annual Savings $	Rebate $	Simple Payback (years)
	39	$4,290.00	6084	$1,155.96	$ 1,950.00	2.0
Totals	39	$4,290.00	6084	$1,155.96	$ 1,950.00	2.0

Description: There are no controls on vending machines.

Recommendation: Install Vendor Misers

	Count	Total Est Cost $	Energy Savings kwhr	Annual Savings $	Utility Rebate $	Simple Payback (years)
	1	$ 175.00	1344	$ 255.36	$ -	0.7
Totals	**1**	**$175.00**	**1344**	**$255.36**	**$0.00**	**0.7**

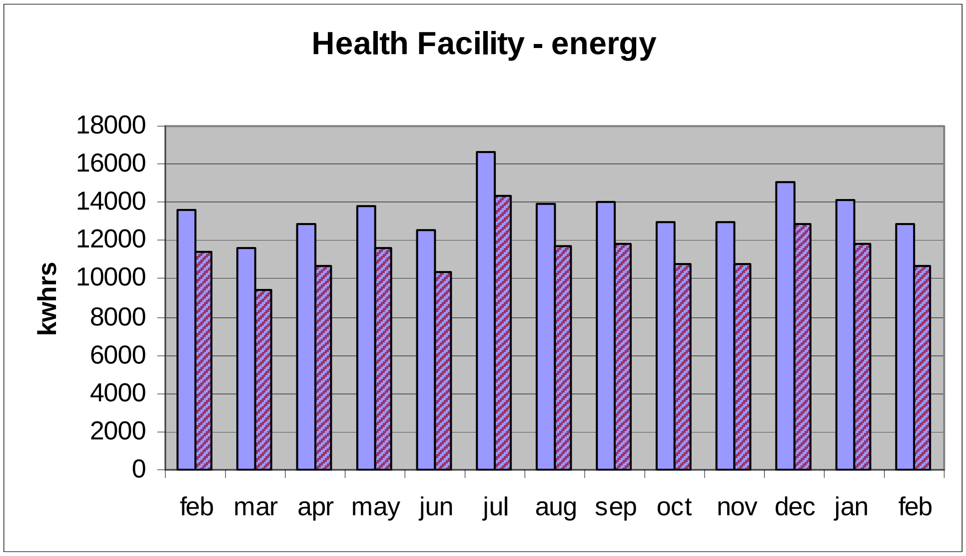
Description: There are automated controls on heating or cooling

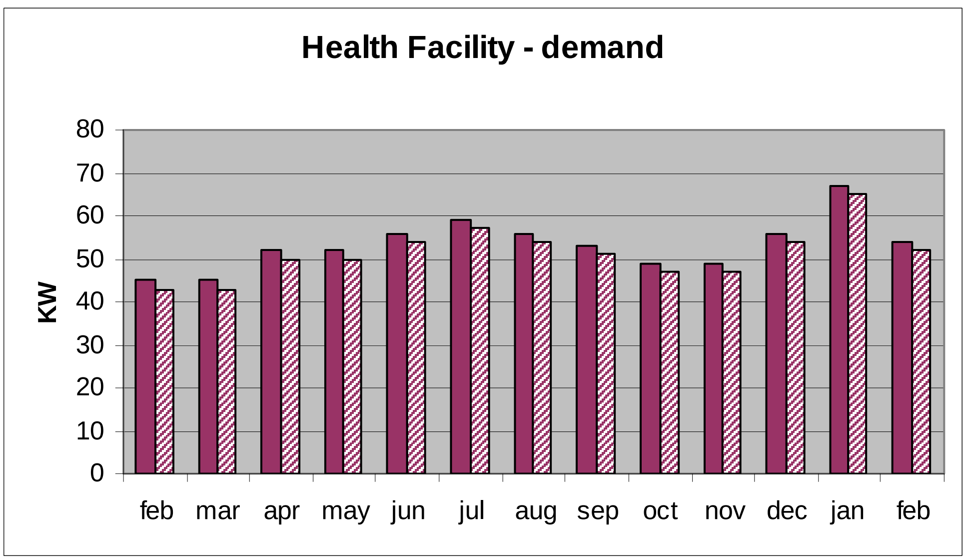
Recommendation: Install setback T'stats in each zone

	Count	Total Est. Cost $	Est Annual Savings kwhrs	Est Annual Savings Oil	Est Annual Savings $	Rebate $	Simple Payback (years)
	12	$4,200.00	0	1582.2	$ 2,215.08	$ -	1.9
Totals	12	$4,200.00	$ -	1582.2	$ 2,215.08	$ -	1.9

Billing Data per Energy Source:

The following graphs indicate energy and demand use before and after proposed ECMs.





2.11 Housing Department

Address: 1 Nohkomess Street

- One story wood frame facility covering 1,700 square feet.
- Operates 40 h/wk.
- Heated by oil hot water boiler.
- TTW AC units.
- The lighting is primarily T12s
- Roughly 25 years old.
- Vending Machines – 1
- Electric hot water. Minimal use.

<u>Recommended Energy Conservation Measures:</u>

1. Dual sensing occupancy sensor for offices.
2. Replace T12s with HPT8s.
3. Replace exit signs with LED exits.
4. “Mizers” or similar controls on both vending machines.
5. Change actuators in thermostats.
6. Set back T’Stats for each zone.

Economics of Recommended ECMs:

Scope: Most of the lighting is obsolete and inefficient. Replace as specified.

	Count	Total Est. Cost $	Energy Savings kwhr	Demand Savings KW	Annual Savings $	Utility Rebate $	Simple Payback (years)
1. Replace existing T12 lamps and ballasts with T8HP systems							
	16	$ -	1517.76	0	$ 588.28	$ 240.00	n/a
2. Replace existing incand exit signs with LED exits							
	3	$ -	226.44	0	$ 87.77	$ -	n/a
3. Replace existing incand bulbs with CFLs							
	6	$ -	526.32	0	$ 204.00	$ 72.00	n/a
Totals:		$3,002.00	2270.52	0	$ 880.05	$ 312.00	3.1

Description: There are no lighting controls.

Recommendation: Install occupancy sensors in offices

	Count	Total Est. Cost $	Est Annual Savings kwhrs	Est Annual Savings $	Rebate $	Simple Payback (years)
	4	$ 440.00	489.6	$ 93.02	$ 200.00	2.6
Totals	4	$ 440.00	489.6	$ 93.02	$ 200.00	2.6

Description: There are no controls on vending machines.

Recommendation: Install Vendor Misers

	Count	Total Est Cost $	Energy Savings kwhr	Annual Savings $	Utility Rebate $	Simple Payback (years)
	1	$ 175.00	1344	$ 255.36	$ -	0.7
Totals	**1**	**$175.00**	**1344**	**$255.36**	**$0.00**	**0.7**

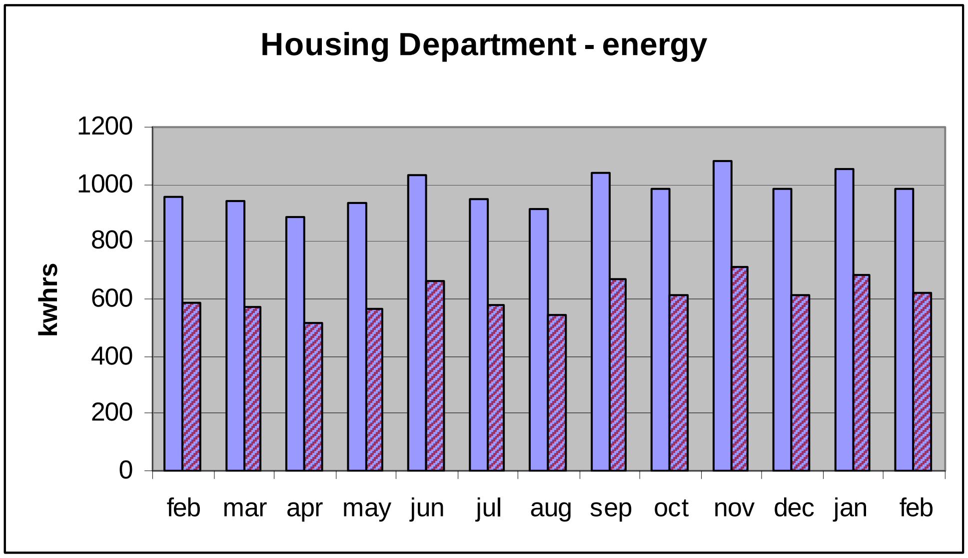
Description: There are automated controls on heating or cooling

Recommendation: Install setback T'stats in each zone

	Count	Total Est. Cost $	Est Annual Savings kwhrs	Est Annual Savings Oil	Est Annual Savings $	Rebate $	Simple Payback (years)
	2	$ 700.00	0	263.7	$ 369.18	$ -	1.9
Totals	2	$ 700.00	$ -	263.7	$ 369.18	$ -	1.9

Billing Data per Energy Source:

The following graph indicates energy use before and after proposed ECMs.



2.12 Sarah Springs Nursing Facility

Address: 7 Sara Springs Drive

- One story wood frame facility covering 3,700 square feet.
- Operates 24/7.
- Heated by oil hot water boiler.
- TTW AC units.
- The lighting is primarily T12s
- Roughly 8 years old.
- Electric hot water

Recommended Energy Conservation Measures:

1. Dual sensing occupancy sensor for offices.
2. Replace T12s with HPT8s.
3. Replace exit signs with LED exits.
4. Set back T'Stats for each zone.
5. Change actuators in thermostats.

Economics of Recommended ECMs:

Scope: Most of the lighting is obsolete and inefficient. Replace as specified.

	Count	Total Est. Cost $	Energy Savings kwhr	Demand Savings KW	Annual Savings $	Utility Rebate $	Simple Payback (years)
1. Replace existing T12 lamps and ballasts with T8HP systems							
	38	$ -	15662.88	1.9459	$26,213.27	$ 570.00	n/a
2. Replace existing incand exit signs with LED exits							
	4	$ -	1296.48	0.24827	$ 2,169.78	$ -	n/a
3. Replace existing incand bulbs with CFLs							
	12	$ -	4520.16	1.95261	$ 7,564.90	$ 144.00	n/a
Totals:		$6,004.00	21479.52	4.14678	$35,947.95	$ 714.00	0.15

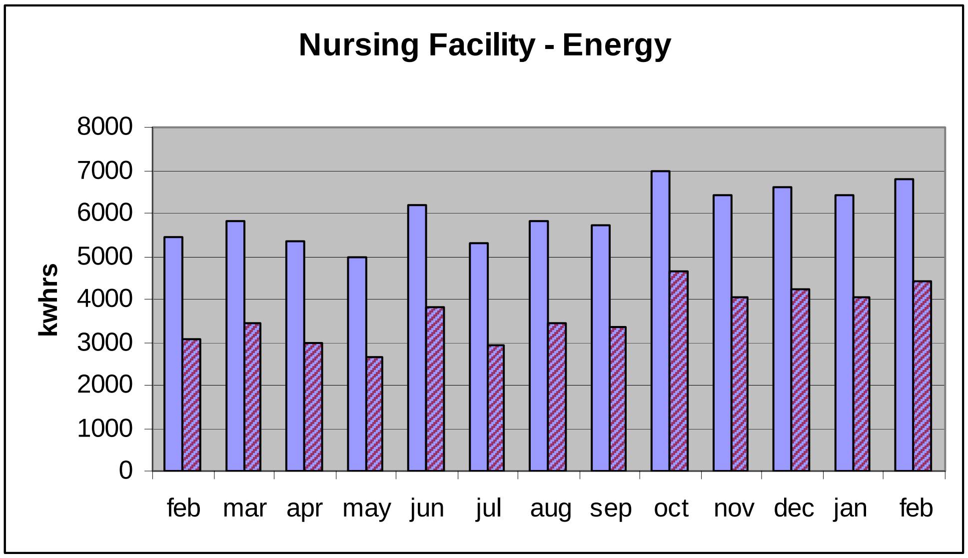
Description: There are no lighting controls.

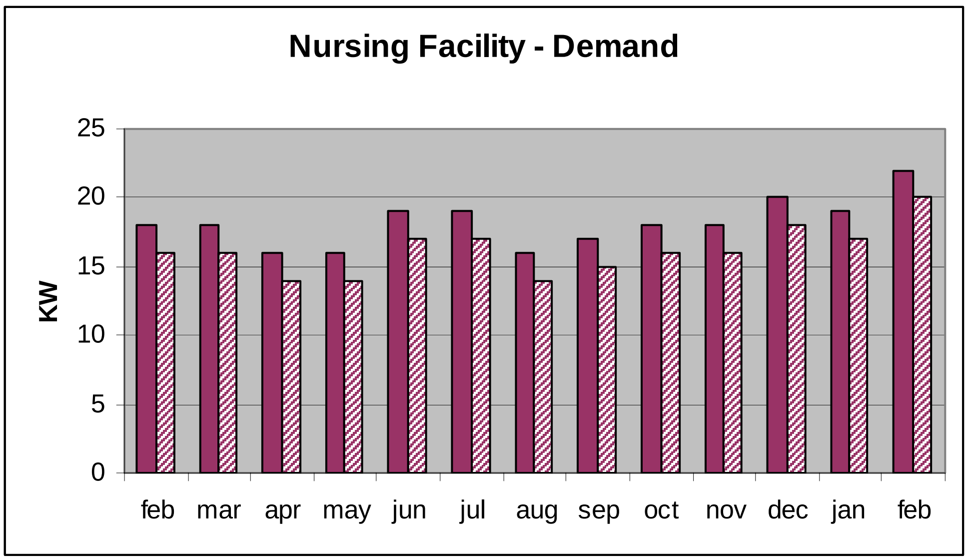
Recommendation: Install occupancy sensors in offices

	Count	Total Est. Cost $	Est Annual Savings kwhrs	Est Annual Savings $	Rebate $	Simple Payback (years)
	10	$1,100.00	5256	$ 998.64	$ 500.00	0.6
Totals	10	$1,100.00	5256	$ 998.64	$ 500.00	0.6

Billing Data per Energy Source:

The following graphs indicate energy and demand usage before and after proposed ECMs.





2.13 Assisted Living Facility

Address: 2 Sarah Springs Drive

- One story wood frame facility covering 2,100 square feet.
- Operates 24/7.
- Heated by oil hot water in radiant floor.
- TTW AC units.
- The lighting is primarily T12s
- Roughly 1 year old.
- Electric hot water

Recommended Energy Conservation Measures:

1. Dual sensing occupancy sensor for offices.
2. Replace T12s with HPT8s.
3. Replace exit signs with LED exits.

Economics of Recommended ECMs:

	Count	Total Est. Cost $	Energy Savings kwhr	Demand Savings KW	Annual Savings $	Utility Rebate $	Simple Payback (years)
Scope: Most of the lighting is obsolete and inefficient. Replace as specified.							
1. Replace existing T12 lamps and ballasts with T8HP systems							
	28	$ -	12228.96	0	$20,353.88	$ 420.00	n/a
2. Replace existing incand exit signs with LED exits							
	4	$ -	1296.48	0	$ 2,157.86	$ -	n/a
Totals:		$6,004.00	13525.44	0	$22,511.74	$ 420.00	0.25

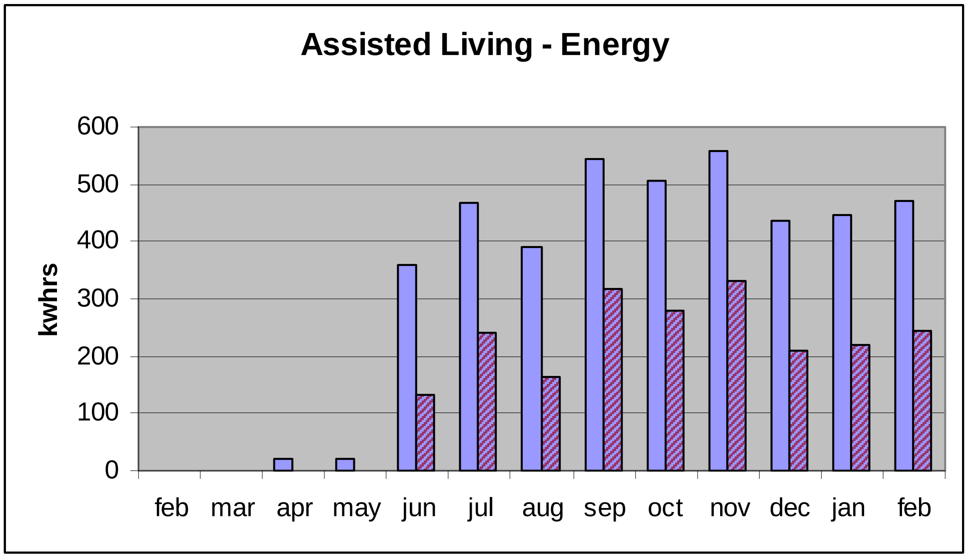
Description: There are no lighting controls.

Recommendation: Install occupancy sensors in offices

	Count	Total Est. Cost $	Est Annual Savings kwhrs	Est Annual Savings $	Rebate $	Simple Payback (years)
	4	$ 440.00	1051.2	$ 199.73	$ 200.00	1.2
Totals	4	$ 440.00	1051.2	$ 199.73	$ 200.00	1.2

Billing Data per Energy Source:

The following graph indicates energy use before and after proposed ECMs.



Appendix

A. Lighting survey from Climo / WestCo

B. Efficiency Maine Rebate information

C. T5 lighting article

D. Occupancy sensor cut sheets

E. Geothermal Heat Pump information form Turner

F. Motor Up motor comparison savings report

G. School Dude information

H. NEEP BOC information

I. Vendor Miser information